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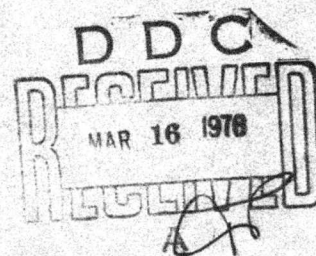
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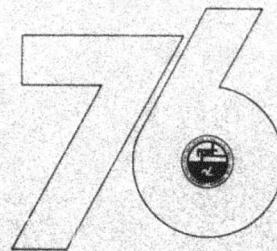
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## FACILITIES MAINTENANCE DEMONSTRATION STUDY

Melvin A. Schwartz



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**FACILITIES MAINTENANCE  
DEMONSTRATION STUDY**

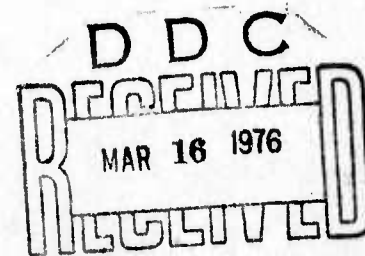
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Facilities Maintenance (FM), as currently performed by shipboard personnel, requires a considerable expenditure of man-hours and material resources.  Due to a number of problems and practices, FM is not performed efficiently. As a result, man-hour expenditures are excessively high; ship's condition, cleanliness and appearance deteriorate; crew morale and motivation are undermined; and cost to the Navy is increased. (Continued) <u>  </u>		

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20. Abstract (Continued)

△ Potential solutions to underlying problems were studied on an operational ship of the FF 1052 class. The solutions included a team approach to the FM work; an information management system for work scheduling; audiovisual training program in FM; improvements in FM equipment and materials; and environmental improvements.

The findings of the study indicated that:

- (1) a significant reduction in man-hour expenditures and cost to the Navy is feasible through a systematic innovation program.
- (2) skill and knowledge of FM team personnel was significantly improved.
- (3) shipboard spaces are cleaner and better maintained with FM innovations, AND
- △ (4) attitude and motivation of FM personnel are not positively affected.

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## FOREWORD

This research has been performed under Work Unit Number WR4-0850 (Shipboard Manning and Automation - Ship Demonstration) in support of the David W. Taylor Naval Ship Research and Development Center's (DTNSRDC) Shipboard Manning and Automation Project (Exploratory Development Task Area SF555 25 21Z).

The project was an outgrowth of the Chief of Naval Operations (CNO) Pilot Program for Reduced Bridge Personnel, initiated in September 1972 in response to CNO/VCNO Action Sheet 333-72 of 13 June 1972. It is one of a series of 6.2 research and development programs with direct laboratory funding to DTNSRDC (Code 2784) from the Chief of Naval Material (MAT-03P). The Navy Personnel Research and Development Center's (NAVPERSRANDCEN) research effort began as part of the joint Fleet/Laboratory team established in June 1972 to investigate reduced bridge manning. This research represents a continuing effort to support the Shipboard Manning and Automation Project Office at DTNSRDC, Annapolis.

The cooperation and assistance of the following persons are gratefully acknowledged:

1. LCDR Steve Kmetz, USN of COMCRUDESGRUTWO/Destroyer Development Group and Messrs. Henry DeBow and Jack Burwell of the Planning Research Corporation, who developed aspects of the test plan, prepared the Ships Facilities Maintenance Organization, and Regulation Manual, coordinated shipboard installations, and collected field data.
2. The staff and crew of USS LAFHEY (DD 724) and USS AYLWIN (FF 1081), who provided hospitality and useful preliminary information.
3. The officers and crew of USS TRIPPE (FF 1075), the test ship, whose cooperation and receptive attitudes were vital to the success of this investigation.
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5. CDR P. Bryan, RN, British Naval Staff, Washington, D.C., who provided valuable assistance to this effort by furnishing technical information concerning ship husbandry in the Royal Navy.
6. The personnel of HMS SULTAN, the ship husbandry training center of the Royal Navy, Gosport, Hampshire, who contributed a large body of data and materials which have been instrumental in structuring various portions of this study program.
7. Capt. T. Barry, USN, Naval Sea Systems Command Technical Representative, Bath, England, who secured data for this study through the Ministry of Defense, Bath.
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9. Mr. R. Sniffin, NAVPERSRANDCEN, who assisted in the analysis and interpretation of the attitude and motivation data.
10. The staffs and crews of the following ships:

USS TRIPPE	(FF 1075)
USS BLAKELY	(FF 1072)
USS BROWN	(FF 1089)
USS HEWES	(FF 1078)
USS BOWEN	(FF 1079)
USS PHARRIS	(FF 1094)

J. J. CLARKIN

Commanding Officer



## **SUMMARY**

### **PROBLEM**

Facilities maintenance (FM), as currently performed by ship's force, requires a considerable expenditure of man-hours and material resources. Problems concerning training, motivation, organization, equipment/materials and procedures prevent FM from being performed efficiently. Consequently, manpower expenditures are excessive; cost to the Navy is increased; shipboard cleanliness, appearance, and condition are degraded; and morale and motivation are reduced.

### **OBJECTIVE**

The objective of this study was to devise, demonstrate, and evaluate methods of reducing shipboard FM man-hour expenditures while improving ship readiness and condition.

### **APPROACH**

Concepts generated for solving current problems fell into the following three categories: (1) manpower organization and information management, (2) training and technical information support, and (3) FM equipment/materials and environmental improvements. Specific concepts included: (1) establishment of a specialist FM team, (2) consolidation of FM tasks, (3) development of an information management and work scheduling system, (4) acquisition and use of a variety of new FM materials and equipment, and (5) development and administration of an audiovisual FM training program.

An implementation and test plan was developed, which included a variety of measurement devices such as skill/knowledge and attitude/motivation tests and subjective rating forms for shipboard cleanliness and appearance. FM innovations were implemented aboard USS TRIPPE (FM 1075) (the test ship), an FM team was selected, and data collection began. At the end of the study, data gathered was analyzed and reported.

### **RESULTS**

1. FM man-hours were reduced from 20 to 40% due to FM innovations.
2. Spaces maintained by the FM team were generally rated as satisfactory or better with respect to overall appearance and cleanliness.
3. FM skill/knowledge of FM members increased.
4. Job attitude and motivation levels of FM members did not increase.
5. The overall FM program and various aspects of it generally received favorable ratings.

## CONCLUSIONS

1. Implementation of FM innovations aboard ship will result in reduced FM man-hours expended, improved appearance and cleanliness of ship's spaces, and increased knowledge and skills in FM procedures.
2. Implementation of FM innovations will not result in improved attitude and motivation of FM team members and overall attitude of the ship's crew.
3. Significant savings, in terms of manpower and manpower-related costs, could accrue if FM concepts used in this study were refined, extended, and implemented in the Fleet.
4. The approach to scheduling and managing FM tasks, the training program, and certain of the FM materials/equipment contributed significantly to the reduction in FM man-hours expended.
5. Although the FM team approach is effective, serious motivation problems arise after personnel are assigned to the team for several months.

## RECOMMENDATIONS

1. A comprehensive information management system, using the Job Information Card format, should be developed and implemented for all FM tasks and all spaces aboard FF 1052 class ships. In addition, the feasibility of this concept for other ship types should be investigated.
2. The audiovisual training program used in this study should be refined and expanded for installation aboard FF 1052 class ships. The applicability of the program for other ship types should be determined.
3. A comprehensive test and evaluation of FM equipment/materials which resulted in reduced FM man-hours should be conducted and specifications established. Following the evaluation and specification process, the equipage list for FF 1052 class ships should be modified to include an appropriate supply of such items.
4. A team approach to the performance of shipboard FM should be utilized with provisions for FM team members to leave the FM team after a temporary assignment.
5. A central storage and distribution location for FM equipment/materials should be established on FF 1052 class ships.
6. Further studies should be conducted to evaluate innovations in surface preparation and corrosion control, bilge cleaning and vent/duct cleaning.
7. Following the implementation of the previous recommendations, a thorough analysis of savings in manpower should be conducted and recommendations for reallocation of personnel or reduction of manning levels should be submitted for implementation in the Fleet.

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## INTRODUCTION

### BACKGROUND

In September 1972, the Shipboard Manning and Automation Project (SMAP) was established in response to the Chief of Naval Operations/Vice Chief of Naval Operations Action Sheet Number 333-72. This Action Sheet assigned priority to programs for reduced shipboard manning (Corder, 1973; Edmondo, 1974), and established a joint fleet/laboratory team to investigate this area. The David W. Taylor Naval Ship Research and Development Center (DTNSRDC), formerly the Naval Ship Research and Development Center, at Annapolis, Maryland, was designated the lead laboratory. Other team members are the Navy Personnel Research and Development Center (NAVPERSRANDCEN), San Diego, California, and the Destroyer Development Group (COMCRUDESGRUTWO, DESDEVGRU), Charleston, S.C.

The objective of SMAP is to reduce shipboard manning while maintaining or improving ship readiness and operational effectiveness.

The project consists of three parts: (1) the CNO Pilot Program for Reduced Bridge Manning, (2) the Laboratory Development Program, and (3) the Ship Demonstration Program (Edmondo, 1974).

The CNO Pilot Program for Reduced Bridge Manning, the first research activity of SMAP, was completed early in FY 1974. Five reports have been published documenting the results of that effort (i.e., COMCRUDESGRU, 1973; Edmondo, Hall, Swartz, & Gullickson, 1974; Frogett & Edmondo, 1974; Lane & Schwartz, 1974; NSRDC, undated). The findings of this research indicated that the number of personnel assigned to bridge watchstanding could be reduced approximately 50 percent, while still maintaining effective prosecution of bridge functions, if procedural, organizational and equipment changes were made (Edmondo, 1974).

The Laboratory Development Program comprises long-range system development efforts which emphasize equipment innovations. Such innovations include an integrated bridge system (IBS) and a modified engineering control system (MECS) (Edmondo, 1974).

The Ship Demonstration Program, a direct outgrowth of the CNO Pilot Program for Reduced Bridge Manning, includes studies of innovations in the following areas (Edmondo, 1974, pp. 1-12):

1. Ship Controlman Concepts
2. Facilities Maintenance
3. Wireless Communications
4. Administration/Support Concept
5. Maintenance and Repair by Own Ship and Tenders
6. Machinery Monitoring
7. Remote Combat Information Center (CIC) Information Display
8. Automatic Man Overboard Alarms
9. Centralized Surveillance and Damage Control Systems
10. Radio Central Improvements

The Ship Demonstration Program develops new man-hours reduction concepts for ships and evaluates the potential for effective manpower utilization by conducting field studies utilizing operational fleet units. The Ship Demonstration Program study described in this report is on shipboard facilities maintenance (FM). Shipboard FM includes those activities performed for purposes of ship preservation, cleanliness, and appearance on non-primary shipboard systems by ship's force, i.e., crew members. This definition excludes activities performed on the basic weaponry, command control and communications systems, maneuvering equipment, and propulsion systems. It includes the tasks of surface preparation, corrosion control, cleaning, titivation, sanitization, and cosmetic practices.

## PROBLEM

FM, as currently performed, at-sea and in-port, by ship's force, requires a considerable expenditure of man-hours and material resources. It is estimated that in excess of 1380 man-hours per week, or approximately 27 man-weeks (i.e., 27 men, working full time) is spent on FM aboard an FF 1052 class ship.<sup>1</sup> This represents approximately 11 percent of the man-hours worked by the total enlisted crew.

Table 1 presents an example of the man-hours allocation, showing the FM workload, by division, on an FF 1052. The theoretical manning level<sup>2</sup> for the Deck Division on most FF-type ships consists of approximately 35 enlisted personnel, whose responsibilities include painting, chipping, peeling, scraping, cleaning, washing, scrubbing, dusting, waxing, polishing, etc. Personnel in other divisions also perform these functions for various assigned spaces.

TABLE 1.  
Total FM Workload on an FF 1052

Division	FM Man-hours Spent per Week
X	28.01
OI	84.27
OC	57.36
1st (Deck Division)	383.59
2nd	34.81
AS	93.05
M	127.75
B	64.05
R	144.49
S	369.58
<b>TOTAL</b>	<b>1386.96</b>

1. This estimate is the calculated FM weekly workload taken from the FF 1052 Ship Manning Document and is probably too conservative. In actual practice, FM man-hour expenditures are considered to be higher.
2. Theoretical manning levels refer to what is called for in the Ship Manning Document for the ship class. Actual ship manning levels are usually lower than those found either in the Ship Manning Document or in the official authorization. It should be clear from this and the previous footnote that more FM work is being done by fewer people than is stated in existing requirements documents. This is not to say that the jobs are getting done satisfactorily.



The annual personnel cost to the Navy for performing shipboard FM on FF-type ships is conservatively estimated to be in excess of \$330,000 per ship. The following method was used to obtain this estimate:

Given:

SNWS = Standard Navy Work Week at Sea (Nonwatchstanders) = 66 man-hours/wk.  
SNWP = Standard Navy Work Week in Port (Nonwatchstanders) = 41 man-hours/wk.  
WAS = No. Weeks at Sea for FF 1052 = 32.24 weeks  
WIN = No. Weeks in Port for FF 1052 = 19.76 weeks  
BC = 1973 Annual Cost of a Boatswains Mate (E3) = \$10,661

Assumptions for this analysis

1. No other ship's work or training for FM personnel.
2. FM personnel are lower-rated nonwatchstanders.

Step 1:

No. of men required for FM =

Total annual FM Time on FF 1052 (incl. 20% productive allowance)  
(SNWS) X (WAS) + (SNWP) X (WIN - 4 WEEKS FOR LEAVE)

31 men =  $\frac{86484 \text{ man-hours per year}}{(66)(32.24) + (41)(15.76) \text{ hours per year}}$

Step 2:

31 men X BC = annual personnel cost for FM work

31 X 10,661 = \$330,491/yr.

While direct personnel costs represent the major portion of FM expenditures, other significant expenses are incurred. Some of these latter costs, such as costs of consumables, equipment, and materials for FM, are relatively easy to determine. However, others, such as costs of generating fresh water for cleaning purposes and maintaining extra personnel aboard because they are needed to perform FM, are more difficult to estimate.

Even if FM were performed in the most efficient manner with respect to manpower organization, technical procedures, and use of efficient equipment and materials, it would continue to represent a significant, albeit necessary, expense to the Fleet. This author contends that FM is not being performed efficiently now and that there are a number of specific problems and practices associated with shipboard FM which tend to increase the annual cost to the Fleet unnecessarily. Several examples of these problems are described below:

1. The personnel performing FM tasks are usually lower-rated men who are neither sufficiently trained nor motivated to perform what they consider to be menial, meaningless work.

2. FM tasks are currently assigned (perhaps misassigned) to people who enlisted to work in specialty areas, such as electronics maintenance. Yet, during the early part of their Navy careers, the majority of their time is spent doing non-technical work, such as FM. A large percentage of nonreenlistment attrition in the Navy today is due to a lack of job satisfaction. Part of the job dissatisfaction is probably due to the disparity between the recruit's expectations and the reality of day-to-day shipboard work. The current practice of misassigning FM work to various would-be specialists probably contributes to their dissatisfaction and lower their motivation to work and to remain in the Navy (Wheeler & Castle, 1973).

Further, the opinion of FM work held by nontechnical specialists who are assigned this work is that it is demeaning and that personnel who are given these assignments are considered less important. This, too, contributes to dissatisfaction, low motivation, and attrition.

3. FM operations are typically scattered throughout the ship, making supervision difficult.
4. Since FM equipment or supplies are not centrally located, maintenance and distribution of this equipment are difficult.
5. FM equipment and materials used does not reflect the more recent advances in the janitorial services and surface preparation fields. Outdated methods, equipment, and materials are used for FM.
6. Ship spaces, particularly on some of the older ships in the Fleet today, have not been designed to consider FM. For example, overheads on ships are usually mazes of pipes, wires, and other dust and dirt collecting structures which are difficult and time-consuming to clean.
7. Standards for appearance and cleanliness have not been defined in sufficient detail and uniformity to permit proper evaluation and work scheduling. Much of the FM work done aboard today's ships is performed for cosmetic purposes, rather than because of a legitimate technical requirement. Too often, painting currently performed aboard ship to maintain its appearance makes FM more difficult and time-consuming in the long run because of poor surface preparation and an inability to recognize the need for such preparation.<sup>3</sup>
8. There is no adequate system for supervising shipboard FM or for keeping track of spaces requiring FM, skills required for various tasks, estimated job time, etc. Further, there is insufficient technical documentation regarding methods and techniques for surface preparation, corrosion control, and cleaning operations. This deficiency is difficult to accept because management information systems

---

3. If the surface was not adequately prepared prior to the application of paint, the new paint will not adhere properly and will blister, crack or otherwise present a poor appearance. Also, possible structural damage, due to neglect of the substrate, is possible.

and documentation concerned with preventive and corrective maintenance on primary weapon and machinery systems have been developed and implemented in the Fleet with considerable success (demonstrated reduced maintenance time, increased reliability, more confidence in equipment).

9. Manuals concerned with preservation of ships are not written so as to be understood and used by the population of personnel who are currently required to perform the tasks (NAVSHIPS, 1970).

The cumulative results of these problems and deficiencies are that (1) ships deteriorate in cleanliness, appearance, and condition because of low quality FM performance, (2) crew morale and motivation tends to be undermined with a concomitant effect on health (personnel availability), personnel turnover, and therefore performance effectiveness (Gunderson & Sells, 1974; La Rocco et al., 1974; Pugh, Gunderson & Dean, 1975), (3) cost to the Navy is increased, and (4) overall ship combat readiness is decreased.

Numerous attempts have been made to identify and deal with problems associated with shipboard FM and many "solutions" have been offered. Yet the same problems seem to recur in the literature with minor variations in phrasing. For example, the report of a study conducted by the Navy Manpower and Material Analysis Center (1973) as recently as September 1972 states:

... The course of the study developed the conclusions that:

- a. Ineffective and inefficient materials are used in shipboard cleaning and painting.
- b. The availability/accessibility of proper tools to perform FM tasks effectively is adequate (sic).
- c. There is a lack of scheduling for FM functions to be performed.
- d. There is inadequate preparation of surfaces prior to painting.
- e. There is unnecessary painting of surfaces.
- f. Cleaning materials are used for rust removal which is in violation of NAVSHIPS instructions.

#### 4. Recommendations

- a. Implement the cleaning and painting materials outlined in Appendix C.
- b. Provide the tools outlined in Appendix B.
- c. Schedule FM functions, with priorities assigned to each task to be performed, as indicated in ... (p. 1-99)

An earlier study, performed by the Fleet Work Study Group, Atlantic in 1965, states:

... analysis of the present cleaning procedures revealed that the required cleaning tasks had never been accurately measured, resulting in a lack of work scheduling, organization and effective manpower utilization . . . .

While investigating the cleaning materials in use, it was determined that some cleaning agents, such as scouring powder and alkaline soap powder, are causing pitting and cracking. The cleaning materials and equipment were found to be outdated, resulting in slow and tedious cleaning procedures, thus wasting manpower.

Recommendations emanating from such studies include a variety of individualized solutions ranging from the use of disposable mess gear and better FM equipment and materials to the development of job scheduling aids (FLTWORKSTUDYGRULANT, 1965; NMMAC, 1973; NAVSHIPS, 1969).

The questions may well be asked at this point, "Why, in view of all the technological developments in the janitorial services and habitability materials fields, do the same problems continue to be cited in reports? Why aren't the various 'solutions' implemented in the U. S. Fleet?"

There are three easily discernible reasons for the inability to deal effectively with the reported FM and manpower problems:

1. Approaches used in the FM and habitability studies are, for the most part, molecular in nature. That is, they tend to deal separately with such items as decking, bulkhead materials, cleaning equipment, etc. (NAS, undated; NASL, 1969; NAVSHIPS, 1969; Smith, Stanley, & Company, 1969). Generally speaking, these studies fail to consider a variety of important interactions among the materials, personnel, training, organization, shipboard environmental features, and equipment. Unless the research community and the Fleet can come to grips with these interactions, the individual problems and solutions (proposed) will continue to occupy low and inconsistent positions on the Navy's priority scale.
2. Even in those studies which do attempt to consider some of the major interactions, quantitative (subjective or objective) criteria and standards for evaluation are lacking. As an example, researchers in habitability often speak of improved motivation and efficiency, but rarely attempt to define those terms such that measurements could be obtained to demonstrate improvements.
3. Research programs rarely have the funding and/or authority to proceed beyond the work study or conceptual phases into an actual demonstration/test phase in which environmental controls and operational fleet units are used. Without demonstration testing, there is a low probability of acceptance by fleet units.

Finally, there is an even greater, perhaps more basic, reason for the continued existence of the stated FM problems — organizational resistance to change. It is commonly accepted that system changes, particularly changes affecting human environmental conditions, are difficult, if not impossible, to implement unless there is an attitudinal change on the part of organization managers and decision-makers — e.g., people who influence the acquisition or alteration of fleet units. Further, it is believed that, if attitudes (of managers and decision-makers) are to be influenced, there should be:

1. Widespread recognition of the technical problem and the financial and operational impact associated with them.
2. A feasible solution or, at least, the promise (through research and development) of a feasible solution.
3. A channel, within the management and/or decision-making organization, for change implementation.

## OBJECTIVE

The objective of the current study was to devise, demonstrate, and evaluate methods for reducing shipboard FM man-hour expenditure while improving readiness and condition of ships.

The specific goals of the study are:

1. To decrease the number of man-hours spent doing FM.
2. To provide cleaner, better looking, better maintained ship spaces and areas.
3. To improve skill and knowledge of personnel performing FM.
4. To improve attitude and motivation of FM workers and ship's crew.

The problem of too molecular a view is addressed in the current study by attacking three basic aspects of shipboard FM simultaneously: (1) manpower organization and information management, (2) training and technical information, and (3) equipment, materials, and environmental improvements.

The problem of quantitative standards for evaluation is addressed, as will be seen, in the design of the instruments used in the current study.

The difficulty of proceeding beyond the conceptual phase of study to demonstration field tests has been solved by the establishment of the present program's funding and authority.

At least a partial solution of the greatest difficulty, that of attitudinal change, is the intent of this report. Its purpose is to create widespread recognition of technical problems in shipboard FM and the related financial and operational impact, and to suggest that some feasible solutions do now exist and can continue to be created through additional research and development.

Somewhere in the Navy management and/or decision making organization, it is believed, a channel for change implementation now exists.



## APPROACH

During this phase of the study, a variety of industrial and military sources were contacted. These sources included cleaning chemicals and materials manufacturers, equipment manufacturers, professional maintenance organizations, consultants, appropriate Navy and other government organizations, shipyards, and foreign naval organizations.

One of the most productive consultations was with representatives of the Royal Navy and the British Ministry of Defense. The entire information management system concept used in this study is based on the ideas which emanated from this interaction (HMS SULTAN Ship Husbandry Course, 1973; Ministry of Defense, 1972).

After extensive discussion with these and other sources, the specific innovations suggested were screened in terms of potential manpower savings, feasibility, safety, and cost. The concepts were then merged to form a design "package" for demonstration and evaluation at-sea. Innovation included in this package fell into three categories: (1) Manpower Organization and Information Management, (2) Training and Technical Information Support, and (3) FM Equipment, Materials, and Environmental Improvements. These categories are discussed below.

### MANPOWER ORGANIZATION AND INFORMATION MANAGEMENT

The following three concepts formed the basis for innovations in this area:

1. One specialist team could perform all FM more quickly and efficiently than it is performed using the current personnel assignment methods. Currently, each division has its own separate FM tasks and spaces. If a division does not have junior enlisted personnel, rated personnel must take time from their normal duties to perform FM.
2. Individual FM tasks could be consolidated and grouped according to job type and space or surface characteristics. The redefined job could then be done more efficiently by members of the FM team.
3. An information management and task scheduling system, similar to the existing Planned Maintenance System, could be developed and used to ensure systematic accomplishment of the FM work. It should be noted that the Royal Navy has recently introduced this concept on ships with moderate success. For years, the hotel industry in the United States has also adopted a similar approach.

A prototype ship's instruction was prepared which provided information regarding the establishment of the specialist, eight-man, FM team. Team members were to be drawn from the Deck Division and supervised by the leading Boatswain's Mate. No watchstanding responsibilities were to be assigned the team. Overall responsibilities of the organization were defined, and management and supervisory guidelines were established in considerable detail.

A prototype management information and task scheduling system was prepared on the basis of space and FM task analyses. The elements of the system included:

1. A Job Information Card (JIC) (Figures 1 and 2) for each consolidated set of tasks and spaces. JICs were developed for approximately 40% of ship spaces. No JICs for painting were developed.
2. A master schedule plan for distribution of JICs to billets.
3. Instructions for using the system.

The system was to operate as follows:

1. The work center supervisor, at the beginning of each week, was to determine which specific JICs were to be used.
2. The supervisor would distribute groups of JICs to the team billets. The individual team member receiving a set of JICs would then know exactly which tasks he had to perform.
3. After completing the task shown on the JIC, the FM team member would record, on the JIC, the data required and would return the completed form to the supervisor.
4. The JICs could then be used to update the master schedule of FM tasks.

NO.	TASK	LIST OF SPACES	MANHOURS	DATE
D-8	VACUUM/DUST	2-54-01-L 2-67-4-L 2-24-0-L 2-29-0-L 2-41-0-L	3.1	3/24/75
SPACE/SURFACE TYPE			BILLET ASSIGN	Actual Job Times
Carpet/Ladders			104	FM 0800 TO 1430
STORES AND EQUIPMENT		PROCEDURE		
Janitorial dustpan, clean cloths, scrub brush, trash receptacle liner, GP detergent, detergent sanitizer, foxtail, stiff bristled broom, advance upright vacuum cleaner, carpet stain remover.		<ol style="list-style-type: none"> <li>1. Pick up all loose trash and put in plastic liner.</li> <li>2. Brush/dust doors and hatches.</li> <li>3. Sweep/dust ladders and back plates.</li> <li>4. Brush edges of carpet toward center with broom.</li> <li>5. Pick up solid crusts with scraper.</li> <li>6. Remove stains.</li> <li>7. Vacuum entire area thoroughly.</li> <li>8. Clean scuttlebutts with detergent sanitizer solution.</li> <li>9. Replace plastic liners as required.</li> <li>10. Clean and stow gear.</li> </ol>		
SAFETY PRECAUTIONS				
<ol style="list-style-type: none"> <li>1. Mix detergent solutions in accordance with instructions on label.</li> <li>2. Avoid cluttering area with cleaning gear.</li> <li>3. Avoid eye contact with detergents.</li> <li>4. Inspect tag and electrical cord and plug of vacuum prior to use.</li> <li>5. Keep cord clear of machine path.</li> </ol>				

Figure 1. Example of a completed JIC (front).





Each training module consists of a set of 35mm slides and a magnetic sound tape recording. Standard 35mm slide projectors and tape players or synchronized projector/sound units were used to present the modules.

Most of the modules show, in step-by-step fashion, how to accomplish specific shipboard FM task. The rest deal with general training, such as safety.

Guidelines for training program administration and attendance recording were prepared for use by the FM team work center supervisor. A technical FM reference package was assembled for use by the FM team and supervisor. The package contained equipment operating instructions, descriptions of and instructions for using FM chemicals and finishes, and an industrially developed handbook.

### FM EQUIPMENT/MATERIALS AND ENVIRONMENTAL IMPROVEMENTS

A variety of recent FM equipment and materials was examined to determine its potential for labor and cost savings, safety, and effectiveness. The materials and equipment shown in Table 2 were selected for use in this study, since they represent an improvement over that currently used aboard ship, supplement existing ship supplies, or represent a new and better method for performing FM. The items in Table 2 were either purchased or made available on a loan basis.

TABLE 2.  
FM Equipment and Materials Used in the Study

Item	Quantity	Intended Function
Pressure washer systems	2	Exterior cleaning
Upright vacuum cleaners	2	Carpet vacuuming
Wet vacuum cleaners	2	Vacuuming noncarpetted deck surfaces, wet pick-up (after stripping or washing surfaces), general vacuuming
Wall cleaning machine (pressurized)	1	Washing bulkheads
Deck scrubbing and buffing machine (nonrotary)	1	Stripping and scrubbing tile, terrazzo and painted deck surfaces
Carpet shampooer	1	Periodic carpet care
Low-pressure sprayer	1	Sanitizing hard-to-reach areas
Spray unit attachment for rotary floor machine	2	Spray buffing
Trash compactor	1	Compacting trash

In addition to the items listed in Table 2, the following materials were purchased:

1. A new type of deck finish and stripper compound for evaluation of a new concept of maintaining tile and terrazzo decks aboard ship. The finish is a metallized acrylic or "metal link" finish, which is soluble in ammonia. When used in a planned program of deck maintenance utilizing the spray buffing<sup>4</sup> or spray burnishing technique, it reportedly extends intervals between deck finish removal operations considerably.
2. Six hundred square yards of carpet for installation in such areas as the ward room, berthing compartments, crew's lounge, CPO lounge, and some passageways. Previous studies had indicated that carpet care was more economical, in terms of maintenance man-hours, than care of resilient deck surfaces (Carpet & Rug Institute, 1969). The present study attempted to evaluate the advantages and disadvantages of carpeting shipboard spaces.
3. Walk-off mats for installation and evaluation in numerous entranceways throughout the ship. It was felt that they would decrease soiling and abrasion of deck surfaces and thereby reduce carpet and tile maintenance requirements.
4. A variety of supplemental supplies (e.g., swabs, detergents, brushes, etc.). Procedures for use or care of the products and materials were developed and incorporated into the training program JICs and technical references.

## **DEVELOPMENT OF AN IMPLEMENTATION AND TEST PLAN**

A master implementation and test plan (Figure 3) was devised. Extensive coordination between contractors and the fleet was required to ensure timely and proper installation.

## **STATEMENT OF HYPOTHESES**

In accordance with the objective and goals of the present study, the following hypotheses were established:

1. The implementation of the aforementioned innovations will result in a reduction of FM man-hours.
2. Appearance and cleanliness of the spaces maintained by the FM team will be judged to be adequate or improved.
3. FM team members will demonstrate that their knowledge of FM requirements, techniques, materials, and procedures has increased.

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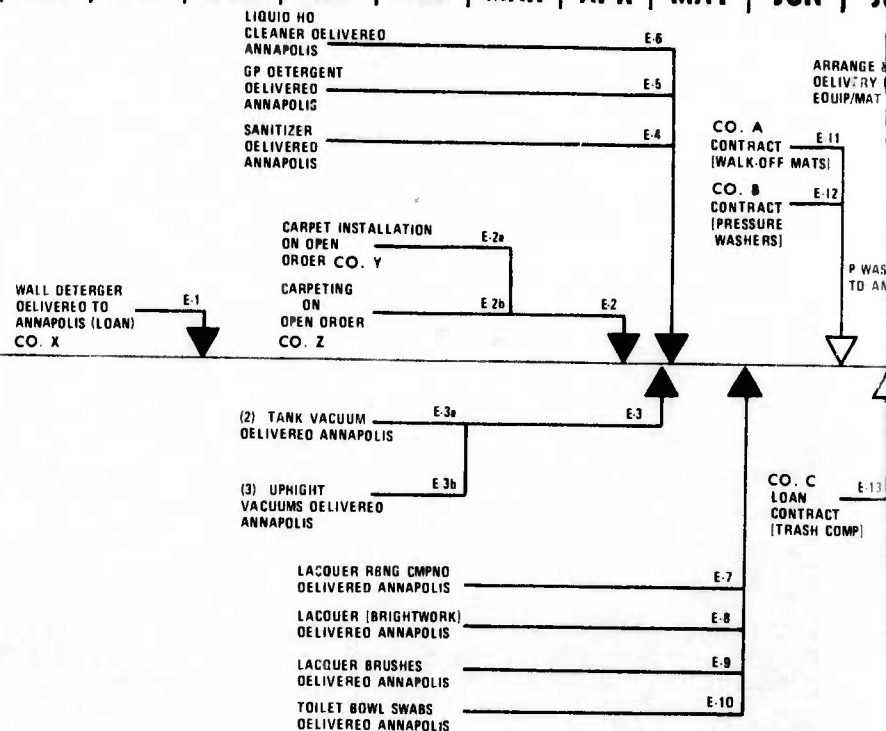
4. This technique consists of spraying damaged areas of finish only and immediately "burnishing" or buffing over the fresh spray with a soft pad rotating at high speed.

# SHIPBOARD MANNING & AUTOM

**FY 74**

JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
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## EQUIPMENT/MATERIALS



## TRAINING PROGRAM

CO. D CONTRACT AWARD

CO. D BOARD LAFFEY FOR SCRIPT DEVELOPMENT

## TASK CONSOLID+MGMT INFORMATION SYSTEM

1st DRAFT OF ORGANIZ CHANGES [SMO MANNING ANALYSIS]

JICS & MGMT AIDS DRAFT

MANNING FINALIZED FOR PILOT

COMPLETE INSPECTION STANDARDS & CRITERIA [USE OF RATING FORMS]

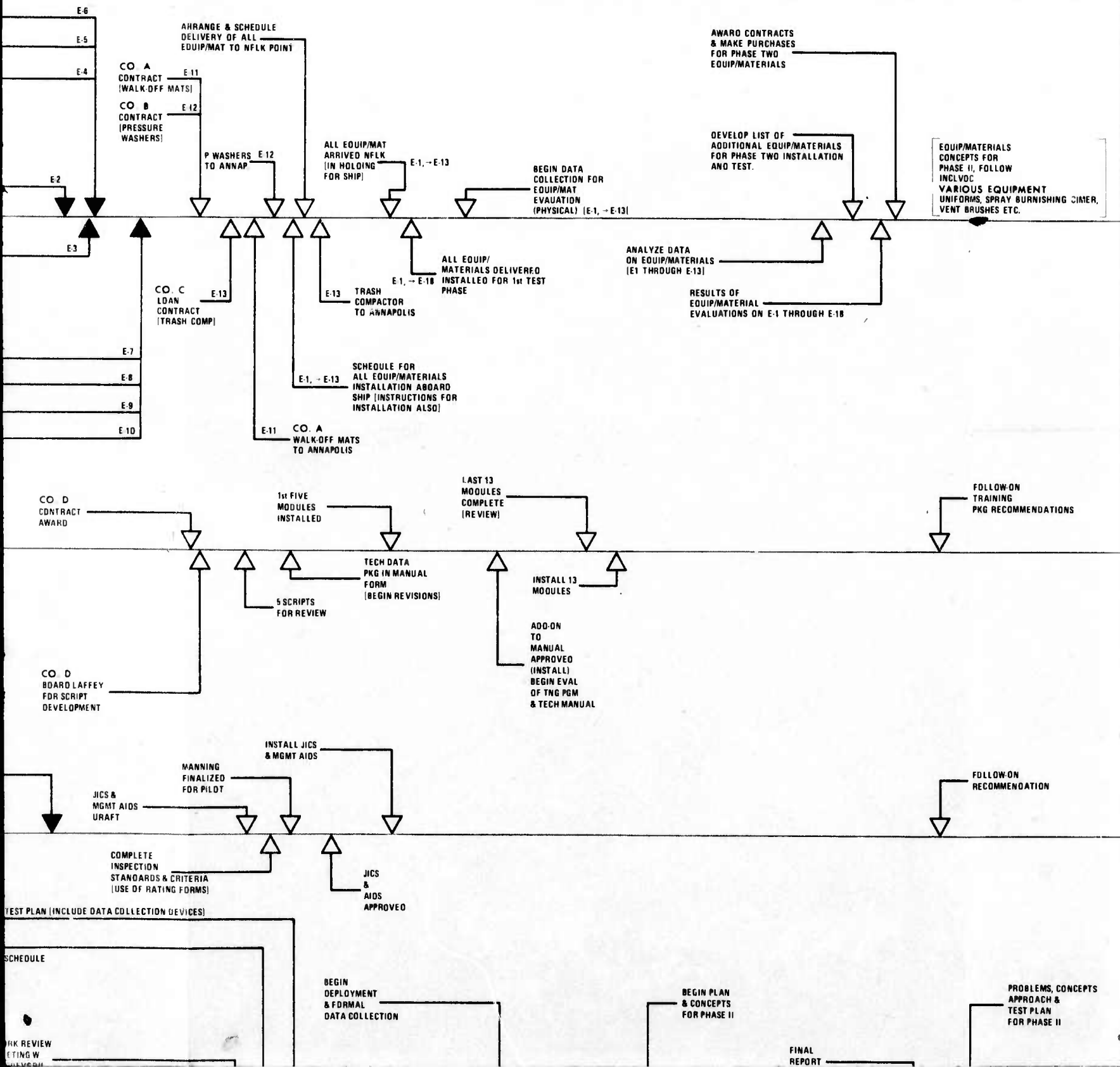
REVIEW & REVISE TEST PLAN [INCLUDE DATA COLLECTION DEVICES] W OESDEVGRU

COMPLETE DETAILED TEST PLAN & SCHEDULE DRAFT

# G & AUTOMATION: FACILITIES MAINTENANCE/MNPWR

## FY 75

R APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT



3

# Y MNPWR STUDY PROGRAM

## FY 76

L	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
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EQUIP/MATERIALS  
CONCEPTS FOR  
PHASE II, FOLLOW  
UP  
VARIOUS EQUIPMENT  
UNIFORMS, SPRAY BURNISHING DIMER,  
ENT BRUSHES ETC.

FOLLOW-ON  
TRAINING  
PKG RECOMMENDATIONS

FOLLOW-ON  
RECOMMENDATION

PROBLEMS, CONCEPTS  
APPROACH &  
TEST PLAN  
FOR PHASE II

# TASK CONSOLIDATION INFORMATION SYSTEM

4

## DEMONSTRATION/TEST

PROBLEM  
ANALYSIS  
BASIC NEW  
CONCEPTS  
DEVELOPED

COMCRUDESANT  
BRIEFED ON  
CONCEPTS  
& APPROACH

DESDEVGRU  
BRIEFED  
ON  
CONCEPTS

DOCUMENT  
PROBLEMS STUDY  
APPROACH &  
GENERAL  
TEST PLAN

REVIEW & REVISE TEST PLAN (INCLUDE DATA COLLECTION)  
W DESDEVGRU

COMPLETE  
DETAILED  
TEST PLAN & SCHEDULE  
DRAFT

WORK REVIEW  
MEETING W  
DESDEVGRU  
ON DATA DEVICES

1ST DRAFTS OF DATA COLLECTION DEVICES

- A. FM SKILL KNOWLEDGE TEST (BEFORE/AFTER)
- B. FM INSPECTION CHECKLISTS (WEEKLY BI WEEKLY) COLLECTED WEEKLY
- C. SUBJECTIVE EVALUATION (APPEARANCE & CLEANLINESS) (BEFORE/AFTER)
- D. FM SUPERVISORS RATING (MONTHLY)
- E. ATTITUDE & MOTIVATION QUESTIONS (BEFORE/AFTER)
- F. HABITABILITY & CLIMATE (BEFORE/AFTER)
- G. WORK TIME LOG (DAILY BY CREW)
- H. EQUIPMENT/MATERIAL USE LOG (AS USED) (COLLECTED)
- I. PROBLEM CHECK LIST (AS USED COLLECTED)



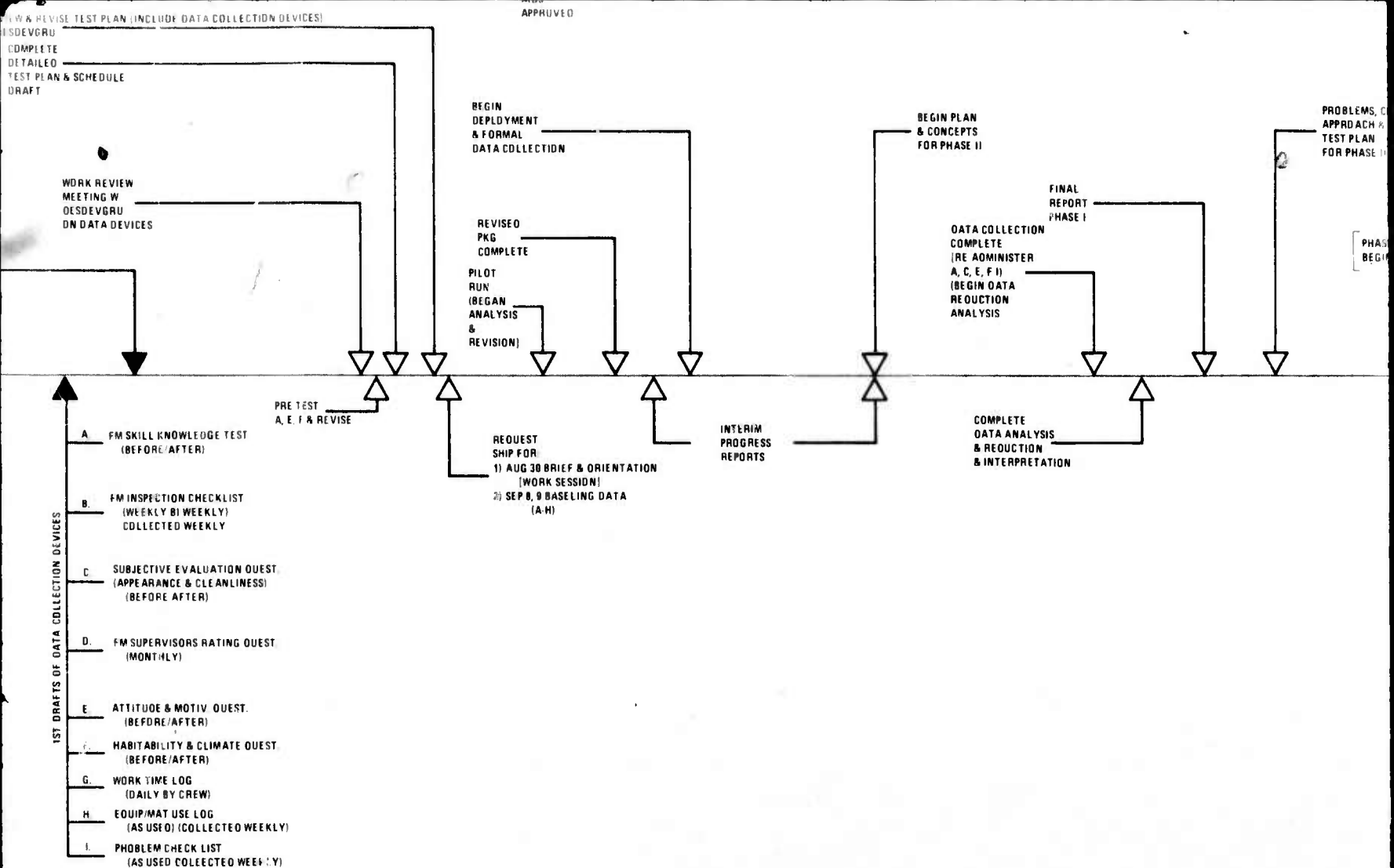


Figure 3. Implementation and Test Plan.

FOLLOW ON  
RECOMMENDATION

PROBLEMS, CONCEPTS  
APPROACH &  
TEST PLAN  
FOR PHASE II

PHASE TWO, FOLLOW ON  
BEGINS 1, July

6

4. Attitudes and work motivation of FM team members and overall attitude of the ships crew will improve.

#### TEST VARIABLES AND MEASURES

The independent variable used in this study was the entire set of innovations. Two basic types of comparisons were planned: (1) conditions "before" vs. "after" on the test ship, and (2) test ship condition vs. control ship(s) condition.

The dependent variables were: (1) FM man-hours, (2) cleanliness and appearance of shipboard spaces, (3) FM skill and knowledge, and (4) attitude and motivation.

The measures of FM man-hours were:

1. Estimates of FM task times on control ships.
2. Estimates of FM task times from documented sources.
3. Actual recordings of FM task times from completed JICs (Figures 1 and 2).
4. Comparisons (on the test ship) between subjectively estimated job times before and after innovations were installed.<sup>5</sup>

Measures of appearance and cleanliness of spaces consisted of (1) completed inspection rating forms using subjective scales (Figure 4), and (2) subjective comments elicited through debriefing questionnaires (Appendix B).

The principal measure of skill and knowledge was a specially designed FM skill and knowledge test (Appendix C). The test was a two-part multiple choice test. Part A presented 100 items dealing with major aspects of FM, and Part B, 30 items on special innovations peculiar to the program, i.e., not general knowledge FM items.

Part A was administered to 36 men in the deck division after the FM team members were selected and before the innovations were installed aboard the test ship. The reliability of Part A was estimated using the Kuder-Richardson formula for estimating reliability (Guilford, 1956, pp. 454-456). The formula and a summary of the results of the Kuder-Richardson estimating procedure are shown below:

Kuder-Richardson Formula:

$$r_{tt} = \left[ \frac{n}{n-1} \right] \left[ \frac{\sigma^2 - \sum pq}{\sigma^2} \right]$$

where  $n$  = number of items in the test

$p$  = proportion (of subjects) passing an item

$q$  =  $1-p$

---

5. Sufficient data on FM task times prior to innovation could not be collected because the character of many of the FM tasks under the new system was radically changed, i.e., certain tasks had been grouped to form a new task while others were broken down into components.

# **FACILITIES MAINTENANCE INSPECTION FORM**

☐ In-port      ☐ Underway      Date: \_\_\_\_\_

Space \_\_\_\_\_ Inspector \_\_\_\_\_

## **Overall Appearance**

☐ Outstanding      ☐ Satisfactory      ☐ Unsatisfactory

## **Rating Scale\***

Excellent:

No Maintenance  
Necessary

1

2

3

4

5

6

Unacceptable:

Comprehensive  
Facilities Main-  
tenance action required

	Rating		Rating
Bulkhead	_____	Buttkits, trash receptacles	_____
Overhead	_____	Lighting fixtures	_____
Deck	_____	Lockers and Furniture	_____
Urinals, Commodes	_____	Scuttlebutts and Dispensing Machines	_____
Basins, Mirrors, Showers	_____	Stowage brackets, Rigging Equipment	_____

Comments: (Special Problems) Head needs good field day and attention to detail.

## **\*Rating Scale**

The meanings of the scale values are as follows:

<u>Values</u>	<u>Meaning</u>
1	The surface/fixture being rated is clean and well maintained. No facilities maintenance work is required.
2, 3,	Minor routing facilities maintenance is required.
4, 5, 6	"Field day" or major facilities maintenance is required.
7	Surface renewal is required (paint, new tile, new carpet, grinding and sealing terrazzo, new non-skid, etc.). The surface cannot be restored through routine or periodic facilities maintenance, e.g., it is not cleanable.

Figure 4. FM Inspection Rating Form.

and the numerator,  $\frac{\sigma^2}{t} - \Sigma pq$ , is the sum of the covariance terms in the summation of item variances and covariances used to express the total test variance, or

$2 \Sigma r_{ij} \sqrt{p_i q_i p_j q_j}$ , where  $p_i = p_a, p_b \dots p_n$  in turn and

$r_{ij}$  = correlation between item i and item j where  $j > i$ .

$\Sigma p_i q_i$	= 18.98
$2 \Sigma r_{ij} \sqrt{p_i q_i p_j q_j}$	= 28.60
$\frac{\sigma^2}{t}$	= 76.187
$r_{tt}$	= .758

As shown above, the test reliability was estimated at .758. Thus, Part A was subsequently judged as adequate for use in the study. In other words, it was felt that it was a reliable device. Test validity, in the statistical sense, could not be determined since no external quantitative criteria were available. However, Part A appeared to have high face validity in that all items therein dealt directly with cleaning or housekeeping procedures, equipment, or materials.

The reliability estimation for Part B resulted in a test reliability of close to zero. Thus, this part was not judged to be a useful instrument in the quantitative estimation of program effects on skill/knowledge. Additionally, due to practical constraints, Part B could not be administered to the same populations regularly. Consequently, no analysis of Part B scores was feasible.

In addition to the skill/knowledge test, comments concerning team skill/knowledge were elicited by interviews and debriefing questionnaires (Appendix B).

Measures of attitude and motivation were collected using a modified questionnaire designed for a related program study (Sniffin, 1975). The questionnaire was based on an expectancy model of work motivation and is presented in Appendix D.

Additional measures of attitude consisted of selected questions appearing in the debriefing questionnaire (Appendix B)

## TEST SHIP DESIGNATION AND EQUIPMENT INSTALLATION

Once the implementation and test plan had been devised, COMCRUDES LANT was informed of the plan and, through the fleet liaison function performed by DESDEVGRU, USS TRIPPE (FF 1075) was designated for participation in the study. The Commanding Officer and staff of TRIPPE received briefings concerning the program objectives, planned innovations, and data collection activities that would take place.

The FM equipment and materials were placed aboard ship. The carpeting, walk-off mats, pressure washer pumps, and trash compactor were installed by contractors.

Following a program orientation briefing, the skill/knowledge and attitude and motivation tests (Appendices C and D) were administered to members of the Deck Division.

The eight enlisted men (either nonrated seamen (SN) or Seaman Apprentices (SA) ) selected and assigned to the FM team received initial training in the use and maintenance of the new equipment and materials. Responsibilities of the team and the new concepts of FM management, training, and operation were discussed with the team and the team supervisors. Data collection responsibilities (for man-hour recording, space inspections and training attendance) were delineated. It should be noted that, due to replacements, sickness, or personnel transfer, a total of 12 men served as FM team members during various phases of the study. Only six served as team members during the entire study period.

## DEPLOYMENT AND DATA COLLECTION

The test ship deployed for 6 months.

Task time data were collected daily for the deployment period. Completed JICs were turned in to the work center supervisor (leading Boatswain's Mate Chief) who retained them for pickup by data collection personnel.

Space inspections were made periodically by officers and the work center supervisor. FM inspection forms (Figure 4) were completed and returned to DESDEVGRU personnel. Approximately three such forms were collected during the period of deployment. Training records were maintained by the work center supervisor, who recorded the dates each team member attended training sessions.

The test ship was boarded by a data collection team approximately midway through the deployment period. Skill/knowledge and attitude/motivation tests were re-administered at that time. Several interviews regarding the progress of the study and effects of the innovations were also conducted.

Towards the end of the deployment period (after the test ship had returned to port), final administration of skill/knowledge and attitude/motivation tests was performed. Additionally, debriefing interviews and questionnaires (Appendix B) were administered.

Data for comparison (control) purposes were collected on other FF 1052 class ships, including but not limited to USS BLAKELY (FF 1072), USS BROWN (FF 1089), USS HEWES (FF 1078), USS BOWEN (FF 1079), and USS PHARRIS (FF 1094). These data comprised estimates of task times and judgments of cleanliness and appearance of shipboard spaces. However, since the raters evaluating the control ships for comparison purposes with the test ship were not the same as those who had submitted the overwhelming majority of ratings aboard the test ship, no direct quantitative comparison was judged feasible in the analysis or interpretation of results.

A similar problem occurred with respect to task time data aboard the control ships. Completed JICs for these were not available since the ships were not using the information management system. Instead, observers interviewed shipboard FM personnel to determine the amount of time spent on certain task aggregates. Thus, interview results could not serve as direct comparisons of FM task times in the analysis. These latter data are nevertheless considered useful and will be discussed later.

The raw data for the entire study was examined and analyzed. The next section presents the results. (A report concerning this study was also issued by COMCRUDESGRU TWO/DESDEVGRU in November 1975).



## RESULTS AND DISCUSSION

### REDUCTION IN FM MANHOURS EXPENDED

#### COMPARISON OF TEST SHIP AND SHIP MANNING DOCUMENT DATA

Table 1 indicates that, according to the FF 1052 Ship Manning Document (SMD), 1st Division personnel spend an average of 383.6 man-hours/week performing FM. This figure is based on work sampling studies and does not relate the time estimate to specific FM tasks. However, each ship has, in its own organization and regulations manual, a cleaning and maintenance bill which assigns to each division specific FM responsibilities. Tables 3 and 4 show a typical assignment of such responsibilities for an FF 1052. It is assumed, for purposes of the following analysis only, that the SMD weekly FM average (383.6 man-hours/week) is required by the 1st Division to clean and maintain the assigned spaces and areas in Tables 3 and 4.

The FM team aboard the test ship performed 2175 FM actions during the deployment period. The average time per action was 2.4 man-hours.

**TABLE 3.**  
Hull Interior — 1st Division Assignments

Compartment	Name
01-101-1-A	Boat and deck gear locker
01-118-1-A	Fueling gear locker
1-54-2-L	Passage
1-54-3-L	Passage
1-67-1-Q	F. M. Jumper Station #1 (to clean)
1-78-4	Rain clothes locker
1-83-2-L	Passage
1-87-4-Q	F. M. Jumper Station #2 (to clean)
1-95-4-L	Passage
1-103-3-Q	F. M. Jumper Station #3 (to clean)
1-105-1-L	Passage
1-105-2-L	Passage
1-118-2	Cleaning gear locker
1-121-0-L	Passage, aft of frame 133
1-125-1-A	Issue room paint mix
1-133-0-A	Bosn. diving gear storeroom
1-133-2-Q	F. M. Jumper Station #4 (to clean)
1-139-1-L	OOD Station
1-139-2-L	OOD Station
1-138-0	Rain clothes locker
1-141-2-L	Passage
1-141-4-A	Deck gear locker



**TABLE 3 – Continued**

1-144-1-A	Mooring towing gear room
2-1-0-A	Boatswain storeroom
2-5-0-E	Windlass
2-29-0-L	Crew living space
2-47-0-L	Crew WR, WC: Forward Decon
2-67-3-L	Passage
2-79-1-L	Passage
2-79-2-L	Passage
2-95-01-L	Passage
3-5-0-K	Flammable liquids storeroom
4-11-0-Q	Chain locker
5-147-1-A	Spl. clothing storeroom

**TABLE 4.**  
**Hull Exterior – Division Assignments**

Division	Area
1st	Sides and superstructure, main deck and below Ground Tackle Boats and davits 01 level weather decks Exterior surface, except as specifically assigned elsewhere
2nd	Mount 51 MK 68 Director and pedestal ASROC Launcher Forward face of ASROC Magazine (up to bridge windows) Torpedo handling and launching equipment
3rd	BT hoist Hydrophone boom TMK 6 winch and housing
OC	Mack (gray areas only) Secondary Conn and horizontal surfaces of after deck house 02 level Communications Antennas
OT	All antennas & platforms except communications antennas Mack (black areas only)
M	Topside remote valve fittings
R	Topside shore power connections
S	Ship's bell

The product of the average time per action and the number of actions represents the total amount of time (in man-hours) spent on FM by the team, i.e., 2175 actions X 2.4 man-hours/action = 5220 man-hours.

The deployment period was 23.5 weeks. The average time spent on FM by the team aboard the test ship then was 5220 man-hours ÷ 23.5 weeks = 222 man-hours/week.

If the task set for the team was identical to that shown for the 1st division in Tables 3 and 4, it could be said that implementation of the innovations led to a savings of approximately 42%,<sup>6</sup> that is:

$$383.6 \text{ man-hours} - 222 \text{ man-hours} = 162.6 \text{ man-hours or } 42\%.$$

However, the tasks accomplished by the FM team were not identical with those shown in Tables 3 and 4. Rather, Table 5 shows the spaces and areas assigned to the FM team aboard the test ship. It is important to note that many of the spaces and areas assigned to the 1st Division in Tables 3 and 4 also appear in Table 5 and that Table 4 assigns larger spaces. An examination of Tables 3, 4, and 5 shows that the FM team aboard the test ship had FM responsibilities in excess of that typically required of the 1st Division.

Due to practical constraints, recognized in the early planning of the present study, surface preparation (chipping, scraping, peeling, priming, etc.) and painting activities were not considered in the present study. (Another study dealing with this area is being planned). Therefore, any estimate of savings incurred through the implementation of the innovations is inflated by a factor equivalent to the percent of time spent by the 1st Division (estimated as 20%) on surface preparation and painting tasks.

TABLE 5.  
Areas and Spaces Assigned to the FM Team

Space No.	Name
01-51-0-L	Lobby
01-54-0-L	
01-54-2-L	Passage
01-54-4-L	Bridge Urinal
01-70-0-L	Passage
01-83-1-Q	Fan Room
01-83-2-Q	Fan Room
01-85-1-L	Passage
01-101-0-Q	Fan Room
01-117-2-L	Passage
1-34-1-Q	Fan Room
1-46-1-L	Passage

6. From this it can be seen that each member devoted approximately 28 hours/week to the assigned FM. Additional FM work could have been assigned to the team without creating excessive workload. In this author's opinion, SMD estimates for FM are low (compared to actual expenditures), and 42% savings, with respect to the SMD, seems conservative.

TABLE 5 – Continued

Space No.	Name
1-46-2-L	Passage
1-50-1-L	Passage
1-54-0-L	Passage
1-54-01-L	Passage
1-54-2-L	Passage
1-54-3-L	Passage
1-59-2-Q	Fan Room
1-75-0-L	Passage
1-79-02-L	Passage
1-83-2-L	Passage
1-95-0-L	Passage
1-95-4-L	Passage
1-105-2-L	Passage
1-105-3-L	Passage
1-107-0-L	Unassigned
1-107-2-L	Passage
1-117-0-L	Passage
1-121-0-L	Passage
1-125-3-L	Passage
1-128-0-Q	Fan Room
1-139-1-L	Passage
1-139-2-L	Passage
1-141-2-L	Passage
2-16-2-L	Passage
2-24-0-L	Crew Living Space
2-29-0-L	Crew Living Space
2-41-0-L	Crew Rec Rm & RNO B. Dr. St
2-41-2-Q	Fan Room
2-44-1-L	Passage
2-45-2-L	Passage
2-47-0-L	Crew WR WC SHR & FW & SW Decon. Sta #1
2-54-0-Q	Eng. Dp. Offc. Dmg Control
2-54-01-L	Passage
2-54-1-Q	Exec. Offc.
2-61-0-Q	Mtnce Cntrl Cntr
2-61-2-Q	Unit CRD Office
2-61-3-Q	Supply Dept Offc
2-61-4-Q	WPNS Dept Offc
2-64-2-Q	Oper Dept Office
2-67-1-L	Passage
2-67-3-L	Passage
2-67-4-L	Passage
2-79-1-L	Passage
2-79-2-L	Passage

TABLE 5 - Continued

Space No.	Name
2-88-1-L	Passage
2-95-01-L	Passage
2-103-1-L	Passage
2-121-0-L	Passage
2-121-01-L	CPO Mess RM & Lng
2-127-0-L	CPO Living Space
2-132-0-L	Passageway & Aft Dressing St
2-132-01-L	Pass & Aft Drng St
2-132-1-L	CPO WR, WC SHR SPC & Decon Sta
2-147-1-L	Cleaning Gear Locker
2-149-L	Cleaning Gear Locker
3-29-2-Q	Fan Room
3-37-0-L	Passage
3-37-1-Q	Fan Room
3-45-0-L	Crew Living Space
3-54-2-L	Passage
3-59-2-L	Crew Living Space
3-121-0-L	Crew Living Sp
3-132-0-L	Passage
3-132-2-L	Passage
3-135-1-Q	Fan Room
3-155-1-L	Passage
3-155-2-L	Passage
No space number assigned	Sides and superstructure, Main Deck & below Ground Tackle Boats and davits 01 level weather decks Exterior surface, except as specifically assigned elsewhere.

#### COMPARISON OF TEST SHIP DATA AND CONTROL SHIP TIME ESTIMATES

The original data collection plan (Schwartz, 1973) could not be strictly followed due to a lack of human resources for data collection. As a result, FM task times aboard the control ships were not systematically measured. Instead, data collectors visited the control ships and interviewed the FM personnel to obtain task time estimates for a selected subset of FM tasks. Results are presented in Table 6, along with corresponding times derived from completed JICs.

**TABLE 6.**  
Comparison of Mean Times for Selected Tasks  
from the Test Ship and the Control Ship

Task	Mean Time Test Ship	Estimated Mean Time Control Ship
Vinyl Deck (sweep, swab, buff), Selected spaces.	3.3 hrs/wk	5.0 hrs/wk
Ladders/Deck (dust, sweep, swab), Selected spaces.	10.0 hrs/day	11.0 hrs/day
Heads (4) (all cleaning)	6.0 hrs/day	8.0 hrs/day
Bulkheads/Overheads (wipe, dust, vacuum). Selected spaces.	8.0 hrs/day	6.0 hrs/day

No conclusions concerning the effects of the innovations can be drawn from the data shown in Table 6. However, if the estimates from the control ships were valid, it could be said that the innovations tended to reduce labor expenditure since the mean times aboard the test ship were generally lower than those estimated aboard the control ship (except for bulkhead and overhead cleaning).

#### SUBJECTIVE COMPARISON BEFORE AND AFTER INNOVATIONS

During the structured debriefing interviews conducted at the end of the deployment period, a sample of test ship officers was asked, "Has there been a change in the man-hours expended on typical FM tasks since program implementation?" The sample included the Commanding Officer, Executive Officer, three department heads, and some junior officers. Their responses are presented in Table 7, which shows that, in general, the officers felt that the program innovations led to a reduction in the FM man-hour expenditures. The subjective data obtained from experienced shipboard personnel knowledgeable in the area of FM workload lend considerable support to the argument that there was a reduction (approximately 20%) of FM man-hours for the set of tasks accomplished by the team.

An important inference can be drawn from this analysis and the analysis in the previous section. If the reduction in FM man-hours realized as a result of the innovations amounted to between 15% and 30% (an estimate of the range of FM man-hours actually saved), then implementation of the program for the entire set of shipboard spaces could result in a savings of from approximately 200 to 400 man-hours per week per FF 1052 class ship. Excluding for the moment such factors as collateral duties of personnel aboard ship, it would appear that from four to nine crew members could be made available for other than FM duty aboard ship.



TABLE 7.  
Responses of Test Ship Officers To Question  
Regarding Changes in FM Man-hour Expenditures

Response #	Response
1.	Yes, 20%; As men become more familiar with job and space, time required is reduced.
2.	Yes, less hours expended because not as many hours wasted since work schedules are well laid out.
3.	Not so much a change of man-hours as a shift in the type of personnel who do the work. One seaman man-hour is less valuable than a PO3 or PO2 man-hour.
4.	Probably about the same.
5.	Yes, 15-20% less, as FM personnel become more adept at tasks, fewer hours expended.
6.	Yes, 15-20%, FM times have reduced; fewer people and less time required under FM program.
7.	NA
8.	Yes, the decks take less time to clean once they are prepared properly.
9.	Unknown/my troops spend less time cleaning.

Since actual manning levels rarely conform to those found in the SMD, another way to state the potential effect of the innovations is to say that the required shipboard FM can be performed with the "reduced" level of manning currently found aboard ship.

A related issue to reduction of man-hours expended on FM by the team is the workload changes experienced by the rest of the crew. During the debriefing interviews, a random sample of 11 crew members aboard the test ship was asked, "Has the introduction of the FM concept brought about any changes to your organization or workload structure?" As can be seen from Table 8, the group sampled generally felt that they had more time to devote to their non-FM responsibilities once the FM program was implemented.

The results presented in this section are summarized below:

1. The FM team accomplished Deck Division FM work and a significant portion of the FM work previously assigned to other divisions in significantly less time than that shown in the FF 1052 SMD for Deck Division FM alone. The time savings estimate (in excess of 40%) is somewhat inflated due to the failure of this study to consider surface preparation and painting. The real savings is estimated to be 20% - 30%.
2. In the opinion of the test ship officers, FM man-hours were reduced due to the FM program innovations.
3. In the opinion of test ship crew members sampled, implementation of the FM program reduced the FM workload for nonteam members and increased the hours available for performing their technical duties.

**TABLE 8.**  
Responses of Test Ship Non-FM Enlisted Personnel to  
Question Regarding Changes Due to FM Implementation

Response #	Response
1.	Yes, more manhours available to my work center because I don't have to send a man to the head to clean everyday.
2.	Yes, we were able to start an hour early on our work load due to relief of cleaning responsibilities.
3.	Yes, in our division we have had more time for work in our own ratings.
4.	No. It feels the same as before and after.
5.	Yes, I can devote my time to do my professional duties.
6.	Yes, It has taken some of our workload off and allowed us to concentrate on other areas that need it and the FM spaces are kept up good at the same time instead of spreading us too thin with a dab here and a dab there.
7.	No. We still need to supply men for compartment cleaner . . (illegible).
8.	Yes. It has relieved us of some of our everyday duties.
9.	Yes, Other personnel can devote more time to their rate instead of cleaning spaces.
10.	Yes, more time to do my work.
11.	Yes, it allows me to work on my special duties.

4. While the absence of sufficient control measurements precludes rigorous statistical analyses, the data obtained indicate that the program of innovations significantly decreased shipboard FM man-hours.

#### **APPEARANCE AND CLEANLINESS OF SHIPBOARD AREAS AND SPACES**

##### **RATINGS OBTAINED THROUGH FORMAL INSPECTIONS**

The original plan for collecting sufficient rating scale data concerning cleanliness and appearance of shipboard spaces for the test ship and control ships could not be implemented because (1) judges could not visit the test ship a sufficient number of times, and (2) ratings for test and control ships were not performed by the same judges.

Due to the incomparability of rating scale data from test and control ships, no comparative analysis was performed. However, the rating scale data obtained from the test ship indicated that, in general, spaces inspected were rated as satisfactory or better. Raters employed a 7-point rating scale to rate the overall appearance of spaces (a rating of 1 was outstanding, 3 was satisfactory, and 7 was totally unsatisfactory).<sup>7</sup>

<sup>7</sup> Raters frequently entered the word "satisfactory" on the form and did not assign a numerical value. These were counted as falling on the mid-point (3.5) on the scale.

Table 9 shows the distribution of ratings for all spaces. As can be seen, the mean rating for the total of 269 inspections was 3.2, and 12 inspections resulted in unsatisfactory ratings (5 or higher).

TABLE 9.  
Ratings for Overall Appearance and  
Cleanliness of Shipboard Spaces

Rating	Frequency
1	6
2	45
3	56
3.5	138
4	12
5	7
6	1
7	4
Mean = 3.2	269
$\sigma = .87$	

#### SUBJECTIVE EVALUATION OF APPEARANCE AND CLEANLINESS

During the debriefing interviews conducted at the end of the deployment period, a sample of test ship personnel (9 officers/supervisors, 11 enlisted non-FM team members, and 8 FM team members) was asked if there had been an improvement in cleanliness and appearance of shipboard spaces since the program was implemented. Results of a Chi Square analysis of those responses indicates that, in the opinion of the sampled personnel, there was an improvement in shipboard cleanliness and appearance.

#### SKILL AND KNOWLEDGE LEVELS

As previously mentioned, a test of FM skill and knowledge (Appendix C) was designed for use in this study. Part of the original data collection plan was to administer Part A of this test to all Deck Division members aboard USS TRIPPE three times: (1) before the innovation program began, (2) 3 months after the program innovations were made, and (3) at the end of the total study period (6 months after the start of the innovation program). Due to practical difficulties, such as boarding the ship overseas by the data collectors and the unavailability of personnel during the data collection periods, the original schedule could not be implemented as planned. As a result, some subjects were tested three times, some two, and some only once. If subjects were tested once, their score, could not be used in determining the effect of the innovations. If they were tested twice, both scores were used. If they were tested three times, the first score and the higher of the two remaining scores were used in all analyses.

A total of 36 subjects, 8 of which were designated members of the FM team were tested before the innovation program began. Mean score of the FM team members was 56.0; that of non-team members were 55.5, an obviously trivial difference.

The differences between initial and final scores were computed for each subject in both groups. The mean differences score of the FM team was 10.6; that of the 20 non-FM team members was -.2. Obviously the improvement in test scores of the FM team was significantly greater than that of the non-FM team.

On the basis of these results, it appears that the FM innovation program had the effect of raising the skill/knowledge levels of FM team members.

It should be noted that it is not possible to isolate specific program aspects in terms of their absolute or relative contributions to the rise in skill and knowledge. Score increases could have been due to the training, the information management system, and the new equipment/material or any combination of these. There is also the possibility that the emphasis on FM, made obvious by their briefings, the data collection activities, etc., was a determining factor. Additional study and experience may yield information concerning long-term effects and specific effects of the innovations.

## **JOB ATTITUDE AND MOTIVATION LEVELS**

The changes in FM management, organization, equipment, and procedures were expected to improve the job attitude and motivation of FM team personnel and non-FM team members. The instrument used to measure job attitude and motivation was the Attitude and Motivation (A/M) questionnaire (Appendix D). It was administered twice — at the beginning and at the end of the deployment period.

There were three main sections in the questionnaire. In Part I, which was designed to measure the individual satisfaction with the Navy (SWN), he was asked directly what his attitudes and perceptions were. The other sections were designed to measure job satisfaction and motivation indirectly. The questionnaire was constructed in this manner, (1) to obtain valid direct measures of a person's attitudes and perceptions of his situation; and (2) to endeavor to explain those attitudes and perceptions on the basis of a theoretical model of work behavior.

Parts II and III asked specific questions about the individual's perceptions of the Navy as an organization and his role in the organization. Part II was used to assess the degree of satisfaction the individual felt with regard to various aspects of the Navy and his work. In this study, the variable of attitude was represented by a measure of job satisfaction. Criterion values of job satisfaction were measured on an 11-point scale ranging from 0 (low satisfaction) to 10 (high satisfaction).

Part III was designed to measure the level of work motivation of each individual. Motivation to work was represented by the level of effort an individual was willing to exert on his job. Effort was operationally defined in the questionnaire by presenting a series of 10 statements of work behavior — each representing a differing level of effort — and asking the individuals how often they felt they had worked to the standard described in each statement. The procedure for developing this scale was based on previous research in the field of motivation and performance scale development. (COMCRUDESGRU TWO, 1975, pp. 22,23).

## SATISFACTION WITH THE NAVY (SWN)

A comparison of satisfaction with the Navy (SWN) (Part I) scores was made using a repeated measures analysis of variance design (Winer, 1962). The two groups of subjects were (1) 7 FM team members (test group) and (2) 20 non-FM team members (control group). The results of this analysis are shown in Table 10 and are graphically depicted in Figure 5.

**TABLE 10.**  
Comparison of SWN Scores for Test and Control Groups  
at the Beginning and End of Deployment

Item	Time 1	Time 2	Means
FM	6.14	3.57	4.85
Non-FM	5.29	1.57	3.43
Means	5.71	2.57	
Variance	26.5	1.72	

The F ratio for the main treatment (group) = 3.35, which was not significant at the .05 level for 1 and 12 degrees of freedom. The F ratio for the main treatment (time) = 19.49 which was significant at the .05 level for 1 and 12 degrees of freedom.

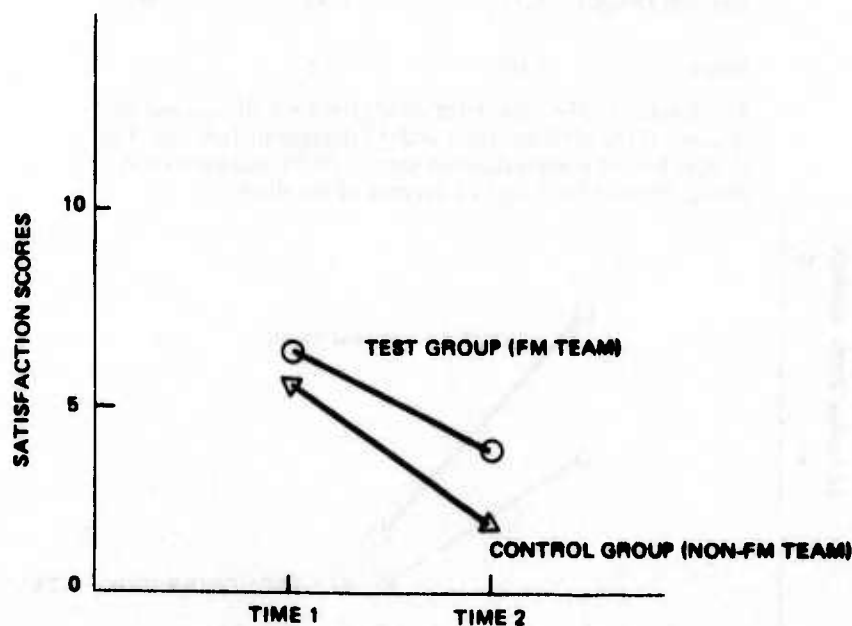


Figure 5. Comparison of SWN scores for test and control groups at the beginning and end of deployment.



As can be seen from Figure 5 and Table 10, the SWN scores decreased for both FM team members and non-FM team members.

It can be speculated that the reason for the marked decrease in satisfaction was due to the fact that the ship was at sea for so long that overall morale, of which satisfaction with the Navy is a major portion, degraded. However, there are many possible "contaminating" factors that could have produced the same effect.

The important point of this analysis is that there is no evidence that the FM innovations had an effect on satisfaction with the Navy.

#### SATISFACTION WITH FACILITIES MAINTENANCE (SWFM)

A comparison of satisfaction with facilities maintenance (SWFM) work scores (Part I, Section C) was made using the same design as in the previous analysis. The results are shown in Table 11 and Figure 6.

**TABLE 11.**  
Comparison of SWFM Scores for Test and Control Groups  
at the Beginning and End of Deployment

Item	Time 1	Time 2	Means
FM (N=7)	7.43	2.29	4.86
Non-FM (N=20)	4.71	1.43	3.07
Means	6.07	1.86	

The F ratio for the main treatment group = 4.05 was not significant at the .05 level for 1 and 12 degrees of freedom. The F ratio for the main treatment time = 29.75 was significant at the .05 level for 1 and 12 degrees of freedom.

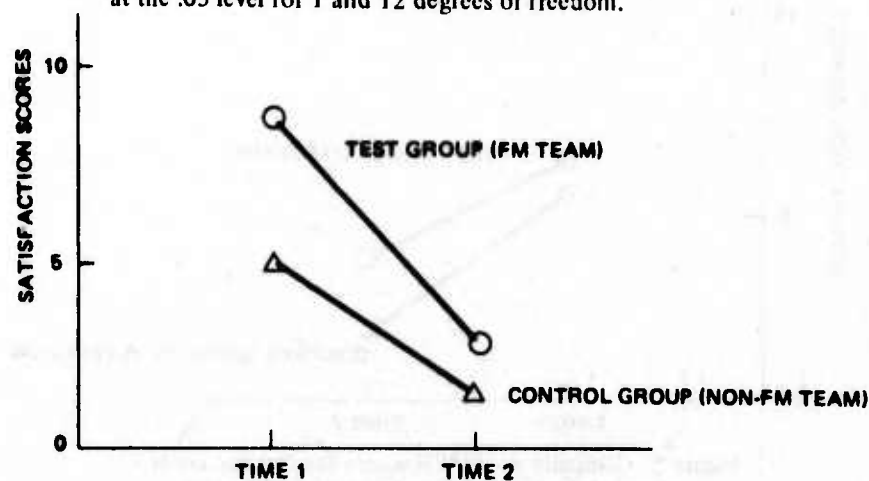


Figure 6. Comparison of SWFM scores for test and control groups at the beginning and end of deployment.

Table 11 and Figure 6 indicate that, as in the previous analysis, there was a marked decrease in the satisfaction score over time and no significant effect arising from the main treatment (group). It does not appear that the FM innovations had a differential effect on satisfaction with FM work as measured by the A/M questionnaire. However, during the debriefing sessions, the FM team members unanimously agreed that they would not like to be a permanent member of an FM team.

### JOB EFFORT INDEX

A job effort index was computed for team and non-team members. A comparison of job effort index scores for the two groups was made using the same design as in the previous analyses. The results are shown in Table 12 and Figure 7.

**TABLE 12.**  
Comparison of Job Effort Scores for Test and Control Groups at the Beginning and End of Deployment

Item	Time 1	Time 2	Means
FM (N=7)	1.89	2.27	2.08
Non-FM (N=20)	1.96	1.86	1.91
Means	1.93	2.06	

The F ratio for the main treatment group = .25, which was not significant at the .05 level for 1 and 12 degrees of freedom. The F ratio for the main treatment (time) = .26, which was not significant at the .05 level for 1 and 12 degrees of freedom.

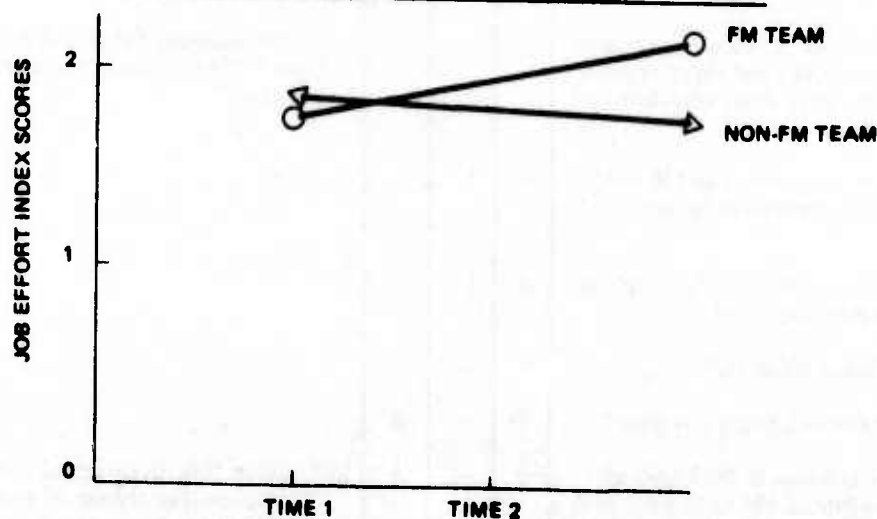


Figure 7. Comparison of job effort index scores for test and control groups at the beginning and end of deployment.

Table 12 and Figure 7 indicate that there was no significant change over time in the Job Effort Index Scores and there was no significant effect arising from the main treatment (group). It does not appear that FM innovation had a differential effect on job effort as measured by the A/M questionnaire.

## PROGRAM ACCEPTABILITY

### OVERALL

Qualitative comments were solicited from supervisors and officers, nonteam crew members, and team members. The data collection vehicles were three debriefing questionnaires, one for officers and supervisors, one for non-team crew members, and one for team members (see Appendix B). These questionnaires were administered at the end of the study deployment period.

Responses to the questionnaires were analyzed in terms of whether they were positive, neutral, or negative towards the program. Tables 13, 14, and 15 present the results of this analysis. Table 16 summarizes the responses.

TABLE 13.  
Officer and Supervisor (N=9) Responses to Selected Debriefing Questions

Questions	Number of Responses			Typical Comments
	Pos.	Neg.	Neut.	
Are other departments giving cooperation or receiving benefits?	9	—	—	Cooperation in form of gladly letting FM (TEAM) assume responsibility . . . Benefits obvious.
Are you aware of any conflicts in organizational responsibilities and chain of command which resulted from implementing this concept?	4	5	—	" . . . they assumed FM would do all required work" "Definition of responsibilities . . . not clear"
Has management and control of FM tasks been improved or impeded by this program?	8	1	—	
Is the management easier or more difficult under the previous system?	6	1	2	
Are schedules being followed?	9	—	—	
Are adequate records being maintained?	3	—	6	
Has there been a change in the man-hours expended on typical FM tasks since program implementation? Estimate of change	6	—	3	20% saving. "My troop spend less time" "Not so much a change of man-hours as a shift in type of personnel . . . one seaman's man-hour is less valuable than a PO3 . . ."

TABLE 13 - Continued

	Number of Responses			
	Pos.	Neg.	Neut.	
Has there been a change in appearance, cleanliness, or condition of ship space since program implementation?	7	1	1	"some passage carpets not feasible" "ship in general is cleaner" "improvement, especially heads" "decks are well covered by . . ."
Is equipment adequate and working properly?	7	—	2	"hi press. washers greatest thing since sliced bread" "Trash compactor is excellent" "Recommend lighter buffer and vacuum cleaner" "Pressure washer outstanding, cleans better, faster and uses about 1/4 fresh water as previous wash-down methods"
Are team members receiving continual adequate formal and on the job training?	2	1	6	"Audio visual training continued, but little OJT"
What is attitude and morale of the FM team?	2	1	6	"variable, fair"
What is the attitude toward members of the FM team expressed by the rest of the crew?	4	2	3	"the poor guys" "Resentment about FM . . not standing watches" "Crew members or FM to pick up their litter" "Initially feeling job was slack . . . the fact that FM . . . worked after hours . . . outstanding appearance . . . eliminated this attitude."

## RECOMMENDATIONS:

1. Manning more men, (10), 3-month assignment, improve management.
2. Organization: PO2 rather than BMC as supervisor, present organization good.
3. Equipment: Better supply support, perhaps 3 small compactors, lighter, more maneuverable, Hi Pressure Washers a must.
4. Materials: No carpet in heavy traffic, delete NOMEX carpetron.
5. Training: Adequate
6. Procedures: Assign FM to port duty. Section liked JICs — incorporate into PMS.
7. Management: Work Center of supply department, not WEPS — incorporate into first division. Time should be programmed to allow for more flexibility.

"A good program. Once initial problem of organization, duty station of FM personnel, etc. are worked out it could be an excellent program."

**TABLE 14.**  
Non-FM Team (N=11) Responses to Selected Debriefing Question.

Questions	Number of Responses			Typical Comments
	Pos.	Neg.	Neut.	
Have you noticed an improvement in cleanliness and appearance of shipboard spaces since this program was initiated?	10	1	—	
Is enough attention being given to FM aboard this ship?	5	3	3	
What is your opinion of the current condition of spaces aboard this ship?	7	—	4	A variety of specific complaints and praises related to particular spaces.
Has the introduction of the FM concept brought about any changes to your organization or workload structure?	9	—	2	1. More manhours available 2. Can devote time to my professional duties. 3. Relieved us of some of our everyday duties.
Do you think the FM team is accomplishing its work efficiently?	8	2	1	
Is the crew lounge clean and in good condition?	7	2	2	Better than before.
Are the heads clean and in good condition?	11	—	—	Better than before.
Are the passageways clean and in good condition?	11	—	—	Better than before.
Do you think the FM team is doing an important job?	9	1	1	Two N/A's.
Would you like to work full time as a member of the FM team?	—	10	1	
Would you prefer working on the FM team or working as a mess cook?	3	3	5	Five said "neither."

TABLE 15.  
FM Team (N=8) Responses to Selected Debriefing Questions

QUESTION	Number of Responses		
	Pos.	Neg.	Neut.
Are you recognized and rewarded for good performance?	4	2	2
Are you able to keep informed about the things you need to know about your work?	7	1	—
Can you usually determine if your performance is satisfactory?	6	1	1
Do you think you're doing a good job?	5	1	2
Is a spirit of cooperation evident in your work group?	3	4	1
How is your work group thought by members of the rest of the crew?	1	6	1
Does the way your work group is organized help or hurt the way the job is done?	5	—	3
Generally speaking, are requirements changed after you begin working on a task?	4	1	3
Is there a need for more personnel in your work group?	2	6	—
Do you understand how your job fits into the mission of this ship?	7	1	—
What is your opinion of the FM Team concepts	1	1	6
Is the equipment you use safe?	8	—	—
Can you count on the equipment to work or does it break down often?	7	1	—
Can you always get what you need to do the job?	5	3	—
Do you think the steps you use for a job are in the right order? Are they correct?	6	1	1
Do you think you have been properly trained to do your work?	5	3	—
Is your work appreciated by other crew members?	3	4	1
Are your hours of work regular or irregular?	5	—	3
Do you have the opportunity to work on different types of jobs?	3	5	—
Is your work group keeping the ship cleaner and in good condition?	6	1	1
Are your job responsibilities clearly defined?	8	—	—
Would most of the personnel in your group want to change to another division?	—	8	—
How much variety is there in your job?	—	5	3
Has the training you received been enough to allow you to do your job well?	6	1	1
Do you feel you're gaining useful and interesting information?	3	4	1
Do you have sufficient technical references for learning about your equipment, materials, and job procedures?	4	3	1



**TABLE 16.**  
Summary of Responses to Selected Debriefing Questions

	Positive	Responses Negative	Neutral	Total
Officers and Supervisors (N=9)	67 (62.0%)	12 (11.1%)	29 (26.9%)	108 (100%)
Non-FM Team Enlisted (N=11)	80 (66.1%)	22 (18.2%)	19 (15.7%)	121 (100%)
FM Team Enlisted (N=8)	114 (54.8%)	63 (30.3%)	31 (14.9%)	208 (100%)
Totals	261 (59.7%)	97 (22.2%)	79 (18.1%)	437 (100%)

As can be seen from Table 16, nearly 60% of the responses were positive, 22% negative, and 18% neutral. In general, it would appear that program innovations are acceptable to personnel aboard ship.

It is interesting to note that the highest relative proportion of negative responses and the lowest proportion of positive responses came from members of the FM team. This seems, upon closer analysis, to be primarily due to the demotivating effect of having to perform what team members considered menial tasks over extended periods of time. The attitude and motivation effects upon team members are discussed elsewhere in this report.

During the course of administering the debriefing questionnaires and conducting informal conversations with shipboard personnel, comments concerning specific aspects of the program were elicited.

The following paragraphs represent a summarization of opinions offered by shipboard personnel at interviews and through equipment evaluation and debriefing questionnaires.

#### **EQUIPMENT/MATERIALS AND ENVIRONMENTAL IMPROVEMENT**

As shown below, the responses elicited in this area were generally positive.

1. **Pressure Washers.** The concept of using high pressure washers was accepted with great enthusiasm. In addition to the recommended use of the systems, other uses have been found which will be explored further. It appears that pressure washers not only reduce man-hour expenditure and do a better job, but they also greatly reduce the consumption of fresh water. It was stated that the systems pay for themselves in the latter manner alone and that "... pressure washers are the greatest thing since sliced bread."
2. **Walk-off Mats.** The concept of using high-performance walk-off mat installations was also viewed positively. The unique characteristics of the product

used (1) afforded excellent traction and excellent durability despite hard use conditions, and a corrosive and wet environment; (2) confined trackage soil, and (3) prevented a good deal of soiling of cleaned spaces.

3. Metallized Acrylic Deck Finish. The concept of using a metallized acrylic or "metal link" deck finish in combination with spray buffing methods worked out extremely well. Intervals between deck stripping (on vinyl asbestos or terrazzo deck surfaces) can be greatly extended, thus saving manpower and material costs. In addition, shipboard personnel feel that their decks never looked as good.
4. Standard Detergents. The concept of correctly using standard GSA heavy-duty detergent, general-purpose detergent, and detergent sanitizer worked well.
5. Carpeting. The reaction to carpeting was mixed. In heavy traffic areas, the carpet wore out quickly and was therefore judged unacceptable. In berthing areas and low traffic places, carpeting was easier to care for and was appreciated from both an esthetic view (habitability seemed improved) and a sound-deadening standpoint. A petroleum spill in the crew lounge area early in the program severely and permanently damaged one-half of the carpeted space, making evaluation there difficult. The damaged portion was cut out and replaced with the product used for walk-off mats. The replacement was viewed as durable and effective in improving habitability and ease of maintenance.
6. Trash Compactor. The concept of using a trash compactor seemed generally appealing, although it was not clear that it directly reduced FM man-hours.
7. Wall Deterger. The concept of using a wall detergent was not viewed as labor saving or more efficient.
8. Hand-Pressurized Sprayers. The concept of using a small hand-pressurized sprayer for cleaning and disinfecting hard-to-reach areas in heads worked well. It resulted in better, easier job.
9. Non-Rotary Floor Machine. The non-rotary floor machine worked well for long straight expanses of deck tile but was viewed as too heavy and bulky for use aboard a FF 1052 class ship. The team experienced difficulty in raising the machine over coamings and transporting it from one level to another. Additionally, the many obstructions on the decks made it difficult to use.
10. Mop Caddies and Buckets. The mop caddies and buckets were too bulky and tended to present difficulties in less than calm sea states.
11. Miscellaneous. The miscellaneous mops, swabs, brooms, squeegees, buckets, brushes and containers were viewed neutrally.
12. Carpet Shampooers and Upright Vacuum Cleaners. Carpet shampooers and upright vacuum cleaners seemed acceptable, but no special comments concerning their use were elicited.
13. Wet Vacuum Cleaners. Wet vacuum cleaners were judged excellent. They allowed efficient and effective clean out of "pockets of potential corrosions." They were also viewed as bulky.

14. Buffing and Stripping Pads. Buffing and stripping pads for the rotary machines were viewed as a significant improvement over previously used materials.

#### TRAINING AND TECHNICAL INFORMATION SUPPORT

Opinions elicited about the training program and technical references were generally positive. It was suggested that, while the training modules imparted a good deal of technical information, they lacked motivational emphasis. That is, the modules trained personnel in job methods and procedures but did not attempt to instill job enthusiasm. In almost all responses, availability of information was viewed as adequate.

#### INFORMATION MANAGEMENT SYSTEM

The JIC system and schedules, coupled with the ship instruction, were received with great enthusiasm by both supervisors and performing personnel. In most cases, it was recommended that the system be placed in continuous use with some modification and expansion.

#### SPECIALIST TEAM CONCEPT

This concept was judged worthwhile, but it was recommended that personnel be assigned to the team for no longer than 3 months. It was suggested, that new personnel should be assigned to the FM team for 3 months, and then assigned to other duties.

In general, non-FM team enlisted personnel liked the concept because it freed them to perform their technical duties.

## CONCLUSIONS

As a result of the preceding analyses, the following conclusions are drawn:

1. The hypothesis that the implementation of the innovations in shipboard FM will reduce FM man-hours is supported.
2. The hypothesis that the cleanliness and appearance of spaces maintained by the FM team will be judged to be adequate or improved is supported.
3. The hypothesis that FM team members will demonstrate an increase in knowledge of FM requirements, techniques, materials, and procedures (as a combined result of the innovations) is supported.
4. The hypothesis that attitude and motivation of FM team members and overall attitude of the ship's crew will improve is not supported.
5. Significant savings, in terms of manpower and manpower related costs, could accrue if the FM concepts used in this study were refined and implemented in the Fleet.
6. The following classes of FM equipment/materials and environmental materials contributed significantly to the lowered FM man-hours expenditure:
  - a. High pressure washer system for exterior cleaning.
  - b. Metallized acrylic deck finish for vinyl asbestos tile or terrazzo decks.
  - c. Hand-pressurized spray devices for sanitization and cleaning under sinks, urinals, etc.
  - d. Liquid detergents and detergent sanitizers.
  - e. Wet vacuum cleaners.
  - f. Buffing and stripping pads for rotary floor machines.
  - g. Walk-off mats.
  - h. Carpet (in low traffic areas only).
7. The approach to scheduling and managing FM tasks (the prototype ship's FM instruction and the Job Information Cards) and the training program were vital factors in reducing FM man-hours and improving shipboard cleanliness and appearance as well as increasing personnel knowledge of facilities maintenance.
8. The team concept approach to performing FM is effective. However, serious motivation problems arise after personnel are assigned to the FM team for several months. FM personnel still feel that such work is menial and demeaning.

## RECOMMENDATIONS

While individual innovations each seem to have merit, it is felt that the full impact on manning and ship condition can best be realized through simultaneous implementation of innovations in (a) manpower organization and information management, (b) training and technical information support, and (c) FM equipment/materials and environmental improvements.

The following recommendations are made:

1. A comprehensive information management system using the Job Information Card format should be developed and implemented for all FM tasks and all spaces aboard FF 1052-class ships. In addition, the feasibility of this concept for other ship classes should be investigated.
2. The audiovisual training program used in this study should be refined and expanded for installation aboard FF 1052-class ships. The applicability of the program for other ship classes should be determined.
3. A comprehensive test and evaluation should be conducted of and specifications established for the following classes of FM equipment/materials:
  - a. High-pressure washer systems
  - b. Wet vacuum cleaners
  - c. Rotary floor machine pads
  - d. Metallized acrylic deck finish
  - e. Walk-off mats
  - f. Hand-pressurized spray devices
  - g. Standard detergents

Following the evaluation and specification process, the equipment list for FF 1052 class ships should be modified to include an appropriate supply of the above items.

4. A team approach to the performance of shipboard FM should be utilized, with provisions for FM team members to leave the FM team after a temporary assignment. The FM team should have responsibility for cleanliness, appearance, and condition of:
  - a. All common use spaces (passageways, heads, ladders, etc.)
  - b. All exterior deck surfaces
  - c. All fan rooms
  - d. Crew and CPO lounges and the ward room
  - e. Selected aspects of berthing compartments

5. A central storage and distribution location for FM equipment/materials should be established on FF 1052 class ships. Equipment/materials distribution should be the responsibility of the work center supervisor for the team.
6. Further studies should be conducted to evaluate innovations in surface preparation and corrosion control, bilge cleaning and vent/duct cleaning. Manpower organization and information management training and equipment should all be considered in such studies and the scope of studies should include the entire ship.
7. Following the implementation of the previous recommendations, a thorough analysis of savings in manpower should be conducted and recommendations for reallocation of personnel or reduction of manning levels should be submitted for implementation in current and future ships of the Fleet.



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**APPENDIX A**

**SAMPLE SCRIPT FOR SHIPBOARD FM TRAINING PROGRAM**

**A-0**

## TRAINING SCRIPT

### Safety in Shipboard Facilities Maintenance Operation

<u>Text</u>	<u>Description of Slide</u>
	0. Logo Slide
1. This is one in a series of training programs covering major areas of shipboard facilities maintenance. Today's training session is . . .	1. Art-General Title
2. Safety in Shipboard Facilities Maintenance Operation. The purpose of this session is to provide some operational guidelines which will ensure your own safety and the safety of others on shipboard when you are performing facilities maintenance tasks.	2. Art—"Safety in Shipboard Facilities Maintenance Operation"
3. Potentially, cleaning operations can create hazards for other persons. While a deck surface is being wet cleaned, a clear passageway should be maintained if that can in any way be done. Also, a "WET DECK" sign should be posted.	3. Art—"Maintain Clear Passage and Post Wet Deck Areas"
4. Never block a passageway with a rope or wire. This could result in serious injury to personnel in an emergency	4. Art—"Never Block Passage with a Rope or Line"
5. If at any time you must leave the area in which your equipment is being used, disconnect any power cords and set all equipment to one side to leave a completely clear passage.	5. Picture of Equipment
6. Make certain of the safety of electrical equipment before using it. Every piece of electrical equipment must carry an electrician's inspection tag dated within seven days of the time of use.	6. Close-up of Tag on Handle
7. Even though the equipment is properly tagged, check plugs and switches. If you are suspicious of their condition, do not attempt to repair them but report them to your supervisor.	7. Close-up of Plug

- |   |   |
|---|---|
| 8. Avoid damaging any of the equipment you are using. In unplugging an electric cord, grasp the plug itself and pull it straight away from the receptacle.  | 8. Picture of Hand Removing Plug  |
| 9. Never detach a power cord by grasping the cord itself and "whipping" it out of the receptacle. This can break the grounding terminal or the cord insulation.   | 9. Picture of Violation   |
| 10. In making adjustments on any powered equipment take the precaution of having the power cord disconnected from the receptacle or at a connection on the equipment itself. Do not depend simply on having the switch cut off, for conceivably it could accidentally be turned on.   | 10. Disconnection at Receptacle or Between Motor and Power Cord             |
| 11. This is the safest way to mount the pad on a floor machine. After the power cord has been disconnected, secure the handle in the vertical position, lay the handle on the deck so that the clutch is fully exposed, and straddle the machine in this position. This way, you can see both the clutch hub and the notches in the clutch plate. | 11. Photo of Safe Mounting Procedure  |
| 12. Vacuum cleaners and shampooers with driven brushes and drive belts must always be disconnected before checking the brush or belt area.  | 12. Checking with Machine Disconnected                                      |
| 13. Tanks of pressure sprayers and pressurized wall washers should be depressurized before the filling cap is opened.   | 13. Close-up of Sprayer or Wall Washer                                      |
| 14. High pressure washers require a special set of precautions, and extensive instructions will be given to any personnel using such equipment.   | 14. Art—"High Pressure Cleaners Require Special Instructions"               |
| 15. Cleaning chemicals are somewhat like the automobile: they can be very useful, but hazardous to those who do not understand or respect them.   | 15. Art—"Drawing of Automobile with Caption — 'Unsafe if improperly used' " |
| 16. The first rule in handling any chemical concentrate is to avoid skin contact. If you accidentally get any chemical concentrate on your skin, wash it off immediately with a flood of water to remove the chemical. Then seek first aid.   | 16. Hand Under Stream of Water  |



- |  |  |
|--|--|
| 17. Be especially careful to protect your eyes from chemicals. Loosen the cap of any container carefully to release any pressure it might contain, and keep your face away from the container while you are doing this.  | 17. Picture Loosening Cap of Container   |
| 18. Should you accidentally splash any chemical into your eyes, flood your eyes immediately with clear water then seek first aid.  | 18. Art—"Flood with Water — Then Seek First Aid"                                 |
| 19. Bowl cleaning acid is strong enough that it should never be handled without rubber gloves. Also, some bowl cleaners give off acid fumes which can be harmful if inhaled.   | 19. Picture Handling Caddy or Acid Bottle With Gloves                            |
| 20. Chemical containers should always be clearly identified with the name of the material, use dilution, and any necessary warnings.   | 20. Picture of Labeled Container.  |
| 21. If you encounter a container which is not properly labeled and need to identify the product, make your first judgment on the basis of the color and thickness of the material.   | 21. Viewing Product  |
| 22. If you are reasonably sure of the identity of the material but need further confirmation, try the sense of smell but with due regard for safety. Never put your nose close to the opening of the container and inhale, for the vapors may be corrosive or toxic.                                 | 22. Container Uncapped But Model Keeping Face Away From Opening                  |
| 23. This is the best way to test the odor of a product. Remove the cap, bring it no closer than several inches from the face, then fan any vapors toward your nose, sniffing but not inhaling.   | 23. Picture of Odor Test   |
| 24. If the test for color, viscosity and odor leave you in doubt about the product, check with your superior. If he cannot identify the product, he will undoubtedly order its disposal to prevent possible accident.  | 24. Contents of Unmarked Container About to be Poured Into Running Water in Sink |
| 25. In diluting any concentrate, always add the properly measured amount of concentrate to the water. Any heat produced in the actual dilution will be dissipated into the water. If water is added to the concentrate, it can result in rapid production of heat and spattering of the concentrate. | 25. Adding Concentrate to Water  |

26. Solvents must be used with great care. They may involve the hazard of fire or explosion, poisoning through inhalation, or damage to surfaces such as resilient tile, plastic, rubber, or carpeting.
27. Never mix cleaning chemicals with each other unless you are instructed to do so and given specific directions. Mixing acids and alkalies can produce a violent reaction. Mixing some other products can produce poisonous vapors. At the very least, mixing two materials may inactivate both of them.
28. As a general rule, once a cleaning material has been poured from its original container into a bucket, jug, or any other container, it should not be returned to the original. This is especially true of floor finish, for it will almost certainly become contaminated with bacteria and if poured back will cause the entire contents of the original container to spoil.
29. The important rule to take away with you from this session on "Safety in Shipboard Facilities Maintenance Operation" is that you are responsible to protect yourself, your shipmates, and the ship from any possible accident due to carelessness in your work. Know how to do the job and exercise that knowledge.
30. This ends the training session on "Safety in Shipboard Facilities Maintenance Operation." Now is the time for discussions and questions.
26. Art -- "Use Solvents With Care and Only as Directed"
27. Art -- "Mix One Chemical With Another Only if Instructed, Then Follow Instructions Exactly"
28. Art -- "Do Not Return Chemicals to Original Container Once They Have Been Transferred"
29. Art -- "Work Safety"
30. Art -- "Safety in Shipboard Facilities Maintenance Operation"

**APPENDIX B**  
**DEBRIEFING QUESTIONNAIRES**

## FACILITIES MAINTENANCE DEMONSTRATION PROGRAM

## Debriefing Interview Format - Crew

Section I. General Information

Ship: \_\_\_\_\_ Respondent \_\_\_\_\_

Date: \_\_\_\_\_ Position/Title \_\_\_\_\_

Time: \_\_\_\_\_ Period Covered \_\_\_\_\_

1. Have you noticed an improvement in the cleanliness and appearance of ship-board spaces since this program was initiated? Explain:

\_\_\_\_\_  
\_\_\_\_\_

2. Is enough attention being given to the facilities maintenance aboard this ship?

Explain: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

3. What is your opinion of the current condition of spaces aboard this ship? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

4. What improvements should be made? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

5. Has the introduction of the FM concept brought about any changes to your organization or workload structure? Explain:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

6. Do you think the FM team is accomplishing its work efficiently? \_\_\_\_\_

\_\_\_\_\_

7. Is the crew lounge clean and in good condition? \_\_\_\_\_

\_\_\_\_\_

8. Are the heads clean and in good condition? \_\_\_\_\_

\_\_\_\_\_

9. Are the passageways clean and in good condition? \_\_\_\_\_

\_\_\_\_\_

10. Do you think the FM team is doing an important job? \_\_\_\_\_

\_\_\_\_\_

11. Would you like to work full time as a member of the FM team? \_\_\_\_\_

Why (not) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## FACILITIES MAINTENANCE DEMONSTRATION PROGRAM

### Debriefing Interview Format – FM Team

#### Section I. General Information

A. Ship \_\_\_\_\_ B. Respondent \_\_\_\_\_  
C. Date \_\_\_\_\_ D. Position/Title \_\_\_\_\_  
E. Time \_\_\_\_\_ F. Period Covered \_\_\_\_\_

#### Section II. Organization/Management/Supervision

1. Are you recognized and rewarded for good performance? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
2. Are you able to keep informed about the things you need to know about your work? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
3. Can you usually determine if your performance is satisfactory? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
4. Do you think you're doing a good job? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



5. Is a spirit of cooperation evident in your work group? Yes \_\_\_\_ No \_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
6. How is your work group thought of by members of the rest of the crew? \_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
7. Does the way your work group is organized help or hurt the way the job is done? \_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
8. Do you have the help you need to schedule your work ahead of time? \_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
9. Generally speaking are requirements changed after you begin working on a task? \_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
10. Is there a need for more personnel in your work group? Yes \_\_\_\_ No \_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

11. Do you understand how your job fits into the mission of this ship? Yes \_\_\_\_ No \_\_\_\_

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12. What is your opinion of the FM team concept? \_\_\_\_\_

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13. What changes would you make in the group or in the way the jobs are done and scheduled? \_\_\_\_\_

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Section III. Equipment/Procedures/Material/Physical Environment

1. Is the equipment you use safe? \_\_\_\_\_

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2. Can you count on the equipment to work or does it break down often? \_\_\_\_\_

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3. Can you always get what you need to do the job? \_\_\_\_\_

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4. (a) What difficulties have you had because of poorly designed spaces? \_\_\_\_\_

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(b) What changes would you make? \_\_\_\_\_

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5. Do you think the steps you use for a job are in the right order? Are they correct?

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6. How would you improve the job methods? \_\_\_\_\_

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7. What materials/equipment do you like best? \_\_\_\_\_

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8. What materials/equipment would you like to get rid of? \_\_\_\_\_

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Section IV. Work Factors

1. Do you think you have been properly trained to do your work? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
2. What is your opinion of working conditions aboard this ship? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
3. What is your opinion of the amount and type of work you are asked to do? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
4. What are the most difficult jobs? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
5. What jobs do you prefer? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
6. Is your work appreciated by other crew members? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

7. Are your hours of work regular or irregular? \_\_\_\_\_

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8. Do you have the opportunity to work on different types of jobs? \_\_\_\_\_

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9. Is your group keeping the ship cleaner and in good condition? \_\_\_\_\_

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10. Are your job responsibilities clearly defined? \_\_\_\_\_

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11. How often do you feel that the amount of work you have to do interferes with how well it gets done? \_\_\_\_\_

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12. Would most of the personnel in your group want to change to another division? \_\_\_\_\_

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13. How much variety is there in your job? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

14. What could be done to improve your job? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

#### Section V. Training

1. Has the training you received been enough to allow you to do your job well? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. Do you feel you are gaining useful and interesting information? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. Do you have sufficient technical references for learning about your equipment, materials and job procedures? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. How often do you use these references? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



5. How can your training be improved? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## FACILITIES MAINTENANCE DEMONSTRATION PROGRAM

### Debriefing Interview Format – Officers and Supervisors, CO, XO, 1st LT, BMC.

#### Section I. General Information (Data to be obtained from ships operations office)

A. Ship: \_\_\_\_\_ B. Respondent \_\_\_\_\_

C. Date: \_\_\_\_\_ D. Position/Title \_\_\_\_\_

E. Time: \_\_\_\_\_ F. Period Covered \_\_\_\_\_

G. Percentage of Time:

(1) Homeport \_\_\_\_\_

(5) Deployed \_\_\_\_\_

(2) In Port \_\_\_\_\_

(6) In Port \_\_\_\_\_

(3) Underway \_\_\_\_\_

(7) Underway \_\_\_\_\_

(4) Inactive \_\_\_\_\_

(8) Inactive \_\_\_\_\_

#### Section II. FM Concept Status

A. Manning/Staffing

1. Describe changes to management of the FM team: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

B. Workload

1. Has the number of tasks assigned to, or accomplished by, the FM team changed since implementation?

Yes \_\_\_\_ No \_\_\_\_

Describe: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. What events have occurred which affected team workload (inspections, staff changes, command priorities, etc.)

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C. Concept Modifications

1. Has the original concept been modified since implementation? Yes \_\_\_ No \_\_\_

If yes, explain: \_\_\_\_\_

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Section III. Organization

A. Configuration

1. What changes were made in the ships organization to implement this concept (changes in watch assignment, work assignments, etc.) \_\_\_\_\_

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B. Relationships

1. What are the lines of communication within FM team and between the FM team and other departments? \_\_\_\_\_

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2. Are other departments giving cooperation or receiving benefits? Yes \_\_\_ No \_\_\_

Explain: \_\_\_\_\_

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3. Are you aware of any conflicts in organizational responsibilities and chain of command which resulted from implementing this concept?

Yes \_\_\_ No \_\_\_ If yes, describe: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

C. Management

1. Has management and control of FM tasks been improved or impeded by this program? Improved \_\_\_ Impeded \_\_\_

2. Is the management easier or more difficult than under the previous system?  
Easier \_\_\_ Difficult \_\_\_

3. Are schedules being followed? Yes \_\_\_ No \_\_\_

4. Are adequate records being maintained?

Section IV. Effectiveness

A. Time (manhours)

1. Has there been a change in the manhours expended on typical FM tasks since program implementation? Yes \_\_\_ No \_\_\_ Estimate of change \_\_\_\_\_

Explain: \_\_\_\_\_  
\_\_\_\_\_

2. Has there been a change in appearance, cleanliness or condition of the ship spaces since program implementation? Yes \_\_\_ No \_\_\_ Explain: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. In what spaces are the changes most noticeable?

List: \_\_\_\_\_ Explain: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. Are special FM tasks being performed properly and on time? Yes \_\_\_\_ No \_\_\_\_

**B. Equipment/Materials**

1. Are sufficient materials (consumables) kept on hand? Yes \_\_\_\_ No \_\_\_\_

Explain: \_\_\_\_\_  
\_\_\_\_\_

2. Is equipment adequate and working properly? Yes \_\_\_\_ No \_\_\_\_

Explain: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Section V. Training and Attitude**

1. Are team members receiving continual adequate formal and on-the-job training?

Yes \_\_\_\_ No \_\_\_\_ Explain: \_\_\_\_\_  
\_\_\_\_\_

2. Are training records being maintained? Yes \_\_\_\_ No \_\_\_\_

3. What is the attitude and morale of the FM team? \_\_\_\_\_  
\_\_\_\_\_

4. What is the attitude towards the members of the FM team expressed by the rest of the crew? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Section VI. Recommendations

What are your recommendations for program improvement?

- A. Manning \_\_\_\_\_  
\_\_\_\_\_
- B. Organization \_\_\_\_\_  
\_\_\_\_\_
- C. Equipment \_\_\_\_\_  
\_\_\_\_\_
- D. Materials \_\_\_\_\_  
\_\_\_\_\_
- E. Training \_\_\_\_\_  
\_\_\_\_\_
- F. Procedures \_\_\_\_\_  
\_\_\_\_\_
- G. Management \_\_\_\_\_  
\_\_\_\_\_



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## APPENDIX C

### SAMPLE ITEMS FROM FACILITIES MAINTENANCE KNOWLEDGE TEST

## **FACILITIES MAINTENANCE KNOWLEDGE TEST**

### **GENERAL INFORMATION**

This is a test to determine your knowledge of facilities maintenance tasks, procedures, principles, equipment and materials. Results of this test will be used by the facilities maintenance study group and will not have any affect on your present shipboard assignment, your qualifications for advancement, or your Navy career.

There are two parts to this test. Part A has 100 items numbered 1-100 and will be taken by all personnel. Place answers to Part A in the appropriate spaces of section "A" of your answer sheet.

Part B has 30 items numbered 1-30 and will be taken only by personnel told to do so by the test administrator. To answer questions in Part B, turn your answer sheet over and place a mark in the appropriate spaces of section B on the sheet.

You may now begin the test.

## **PART A**

1. Normal maintenance of watertight doors, hatches and scuttles should entail no more than regular inspection, operation and lubrication of hinges and clips and cleaning of rubber joints.
  - a. true
  - b. false
2. When stripping solution has been splashed onto the bulkhead
  - a. it should be removed with a clean damp cloth
  - b. it should be squeegeed off
  - c. it should be allowed to dry before removing
  - d. a wet vacuum should be used for removal
3. After stripper has been applied to a deck surface, the amount of time required to dissolve the old finish and soil is
  - a. one minute
  - b. five minutes
  - c. fifteen minutes
  - d. one hour
4. Bulkheads should be cleaned
  - a. from the top down
  - b. from the bottom up
  - c. from left to right
  - d. from right to left
5. Once stripper has been applied to an area and starts to dry
  - a. swab the surface with a dry swab
  - b. more stripping solution should be applied
  - c. apply the final finish
  - d. spray buff the area
6. Pipes under basins in the lavatory areas should be cleaned
  - a. twice each day
  - b. twice each week
  - c. twice each month
  - d. once each month
7. When sweeping with a straw broom, the same side of the broom should be continuously used.
  - a. true
  - b. false

8. Good ventilation within a ship is necessary for the
  - a. health and comfort of ship's company
  - b. preservation of stores
  - c. efficient operation of equipment
  - d. all of the above
9. Lavatory fixtures (sinks and faucets) should normally be cleaned using
  - a. cleanser and brush
  - b. detergent-sanitizer, spray bottle and cloth
  - c. steel wool and soap
  - d. heavy duty detergent solution and cloth
10. You should empty the vacuum cleaner dustbag/container before each use.
  - a. true
  - b. false
11. If awkward corners are kept clean, the rest will almost look after itself
  - a. true
  - b. false
12. Floor scrubbing and stripping equipment is easiest to clean
  - a. after stripper has dried
  - b. with descaling compound
  - c. immediately after use
  - d. before disconnecting
13. Wax and finish stripper tend to remove a little bit of the life from tile every time they are used.
  - a. true
  - b. false

**APPENDIX D**  
**ATTITUDE AND MOTIVATION QUESTIONNAIRE**

**D-0**

Personnel Identification No.: \_\_\_\_\_

## FACILITIES MAINTENANCE STUDY QUESTIONNAIRE

In this questionnaire, we will be asking you a number of questions about how you feel about your job, the Navy, and many related things. The information you provide will be kept strictly confidential, so please try to be accurate in your responses.

There are three main parts to this questionnaire. The first asks you about your general feelings towards a number of jobs, ratings, and assignments. In the next two sections, we ask you more detailed questions about these things. It should take you less than an hour to complete the entire questionnaire. If you have any questions, feel free to ask the person administering the questionnaire. Thank you.

### BACKGROUND

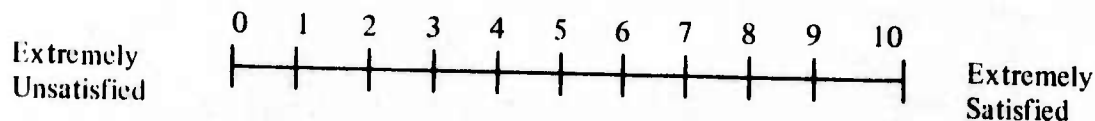
1. SHIP: USS \_\_\_\_\_
2. DATE: \_\_\_\_\_
3. RATE/RATING: \_\_\_\_\_
4. YEARS IN SERVICE: \_\_\_\_\_
5. ENLISTMENT: FIRST \_\_\_\_\_ SECOND \_\_\_\_\_ THIRD OR MORE \_\_\_\_\_
6. PRESENT SHIPBOARD ASSIGNMENT: \_\_\_\_\_
7. TIME ON PRESENT ASSIGNMENT: \_\_\_\_\_
8. EXPECTED REASSIGNMENT OR RELEASE DATE: \_\_\_\_\_

### PART I

In this section we would like some information on how you feel about your career in the Navy and your plans for the future.

### SECTION A

Using the scale below, rate the overall satisfaction you feel or think you would feel as a member of the three different types of organizations listed below.



1. How satisfied do you currently feel with the Navy as an organization: \_\_\_\_\_
2. How satisfied would you feel as an hourly production worker in a large corporation like G.M.? \_\_\_\_\_



3. How satisfied would you feel as a production worker in a small town manufacturing plant \_\_\_\_\_

#### SECTION B

Using the same scale as above, rate the overall satisfaction you feel, or think you feel, in the ratings shown below.

1. Boiler Technician (BT)
2. Storekeeper (SK)
3. Quartermaster (QM)
4. Boatswain's Mate (BM)
5. Signalman (SM)
6. Electronic Technician (ET)
7. Steward (SD)
8. Hull Technician (HT)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

#### SECTION C

Again, use the scale above to rate the overall satisfaction you feel, or think you would feel, in the different job assignments.

1. Facilities Maintencenceman
2. Helmsman
3. Mess Cook
4. Lookout

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

#### SECTION D

Circle the number of the statement that best describes your career intentions at the present time.

1. Definitely will leave
2. Uncertain, but probably will leave
3. Undecided
4. Uncertain, but probably will stay
5. Definitely will stay

How much as your present shipboard assignment affected your decision about your career with the Navy?

1. Not at all
2. Some
3. Very much

My best estimate of the number of years I will stay in the Navy is: less than 5 \_\_\_\_\_ ,  
6-10 \_\_\_\_\_ , 11-15 \_\_\_\_\_ , 16-20 \_\_\_\_\_ , 21-30 \_\_\_\_\_ .

### SECTION E

Circle the number of the statement that best describes your intentions about your rating.

1. Plan to submit a Special Request Chit to change my present rating.
2. Am considering the submission of a Special Request Chit to change my present rating.
3. Not really sure what I will do about my rating.
4. Have no intention of requesting a change in rating at this time.
5. Plan to remain in my present rating during my Navy tenure.

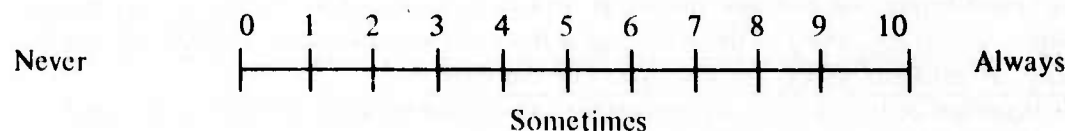
### SECTION F

Circle the number of the statement that best describes what you might do about this or your next assignment.

1. Plan to request my leading Petty Officer to change the nature of my present assignment.
2. Will probably try to avoid getting another assignment like the present one.
3. Not really sure about this assignment.
4. Have no objections to getting a future assignment that is similar to the one I have now.
5. Plan to try to remain in my present assignment as long as possible.

### SECTION G

In this section we would like to know something about what you do in your job. Below is a list of ten things you might have done on your job in the last 2 months. Using the scale shown below, estimate how often you think you have done each thing on the list in the last 2 months and put the appropriate scale number next to each statement.

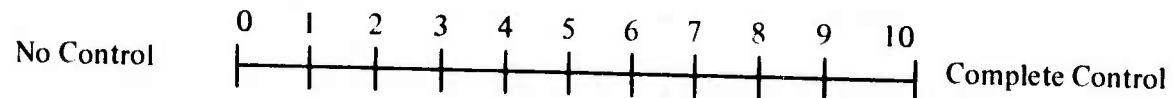


1. Voluntarily use liberty or after-working hours to work on useful tasks, in addition to fully using work time. \_\_\_\_\_
2. Voluntarily use normal breaks and meal time to work on useful tasks in addition to fully using work time. \_\_\_\_\_
3. During working hours, complete assigned work early and then begin working a new task or ask for a new assignment. \_\_\_\_\_

4. During working hours, complete assigned work early and then wait for next assignment. \_\_\_\_\_
5. During working hours, take as much time as possible to complete assigned tasks. \_\_\_\_\_
6. Seek assistance from others to help complete my assigned task. \_\_\_\_\_
7. Delay working on assigned tasks as long as possible. \_\_\_\_\_
8. Avoid being given task assignments. \_\_\_\_\_
9. Find ways to be away from workplace. \_\_\_\_\_
10. Don't work on assigned tasks. \_\_\_\_\_

## SECTION II

1. How much control do you have over how often you do the above things? \_\_\_\_\_



## PART II

There are many things that can result from any particular job assignment or position. We are going to call these things outcomes. For example, you may find that an outcome of being in the Navy is "a feeling of accomplishment." Also, you may find that your present assignment leads to lots of watch standing.

Below is a list of outcomes that you may have experienced or expect to experience in a wide variety of job assignments in and outside of the Navy. From this list, select the five outcomes that concern you most or are most important in influencing the way you feel about job assignments and write them on the fold-out page next to the letters A through E. The fold-out page for this section is page B-8. Put the most important outcome on line A, the second most important outcome on line B, and so on down to line E. Remember, these are outcomes which concern you the most and influence the way you feel about job assignments; these are not necessarily the ones you like the most.

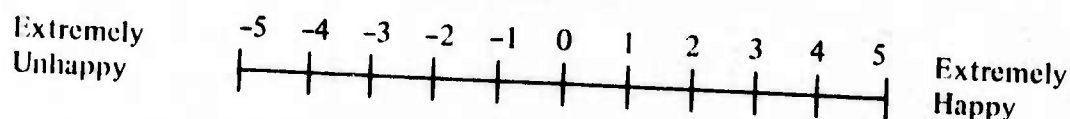
If there are outcomes that are important to you but they are not on this list, add them to the list and your fold-out page.

- \_\_\_\_\_ Criticism of my work
- \_\_\_\_\_ A feeling of accomplishment
- \_\_\_\_\_ High pay and benefits
- \_\_\_\_\_ Good job security
- \_\_\_\_\_ Lots of watch standing
- \_\_\_\_\_ Monotonous or dull work

- \_\_\_\_\_ Interesting work
- \_\_\_\_\_ Recognition for my accomplishments
- \_\_\_\_\_ Time to get my work done
- \_\_\_\_\_ Lousy working conditions
- \_\_\_\_\_ Valuable job and skill training
- \_\_\_\_\_ Difficult work
- \_\_\_\_\_ Opportunity to work with my friends
- \_\_\_\_\_ Lots of time with my family and/or friends
- \_\_\_\_\_ A say in rules that affect me
- \_\_\_\_\_ Lots of free time off the job
- \_\_\_\_\_ Promotion opportunities
- \_\_\_\_\_ Unusual working hours
- \_\_\_\_\_ Lots of liberty or leave
- \_\_\_\_\_ "Dirty" work (Special details)
- \_\_\_\_\_ The opportunity to visit interesting places
- \_\_\_\_\_ The opportunity to meet interesting people
- \_\_\_\_\_ Opportunity to direct activities of others
- \_\_\_\_\_ High prestige work
- \_\_\_\_\_ A good retirement plan

### SECTION A

For each of the five outcomes you have selected, we would like to know how you would feel if you were to receive it, and how you would feel if you did not receive it. Use the scale below to rate your happiness with receiving each outcome. Put the number on the scale that best describes your feelings next to each outcome question. For example, if receiving Outcome A on your list would make you feel extremely happy, put a 5 in the space next to question 1. Also, if receiving Outcome B would make you feel somewhat bad, you might put a -2.



1. How happy would you be to get Outcome A? \_\_\_\_\_
2. How happy would you be to get Outcome B? \_\_\_\_\_

3. How happy would you be to get Outcome C? \_\_\_\_\_
4. How happy would you be to get Outcome D? \_\_\_\_\_
5. How happy would you be to get Outcome E? \_\_\_\_\_

Now, using the same scale as above, rate your happiness with not receiving each outcome. As before, put the number on the scale that best describes your feelings next to each outcome question.

6. How happy would you be not to get Outcome A? \_\_\_\_\_
7. How happy would you be not to get Outcome B? \_\_\_\_\_
8. How happy would you be not to get Outcome C? \_\_\_\_\_
9. How happy would you be not to get Outcome D? \_\_\_\_\_
10. How happy would you be not to get Outcome E? \_\_\_\_\_

### SECTION B

In the last section you told us what outcomes were important to you and how you feel about them. Now we would like you to estimate your chances of receiving each outcome as a result of different job alternatives you might have.

You may feel that your chances of receiving an outcome like being separated from family or friends is very likely by being in the Navy, and not so likely if you worked for G.M. In addition, you may estimate your chances of receiving your Outcome B as very high if you were in a different assignment.

Please estimate your chances of receiving each of your five outcomes for each of the job alternatives listed. Do this by placing the letter of your outcomes in the box which best indicates your estimated chances of receiving each outcome (A-E). An example of what two completed lines might look like is shown below.

### EXAMPLE

Job Alternative	<u>Chances of Receiving Outcomes</u>									
	No Way 0%	10%	20%	30%	40%	50%	60%	70%	80%	Every Time 90% 100%
Owning your own business				A		E		D		BC
Letter carrier for U.S. Mail Service			AE			B		C	D	

Complete one job alternative at a time; asking yourself: "If I worked in this organization or had this job, what are the chances I would receive Outcome A?" Repeat this procedure through Outcome E. Be sure you use all five outcomes with every job alternative. You may put more than one letter in any box.

If you have any questions please ask.

Please begin on the next page.

### Chances of Receiving Outcomes

<u>Job Alternative</u>	No Way			Maybe						Every Time	
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
The Navy as an organization.											
A large corporation like G.M. (as a production worker).											
A small town manufacturing plant (as a production worker).											

### SECTION C

Now we would like you to do the same thing for different ratings in the Navy. In other words, estimate your chances of receiving each outcome for each of the ratings listed below, even though you may not be in that rating. Estimate your chances of receiving each outcome for each rating by putting the outcome letter in the boxes like you did on the last page.

### Chances of Receiving Outcomes

<u>Rating Alternative</u>	No Way			Maybe						Every Time	
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Boiler Technician (BT)											
Storekeeper (SK)											
Quartermaster (QM)											



### Chances of Receiving Outcomes – Continued

	No Way		Maybe								Every Time	
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
Boatswain's Mate (BM)												
Signalman (SM)												
Electronic Technician (ET)												
Steward (SD)												
Hull Technician (HT)												

### SECTION D

Using the same outcomes and the same process as before, rate your chances of receiving each outcome as a result of different job assignments on this ship.

	<u>Chances of Receiving Outcomes</u>											
Job Assignment Alternative	No Way		Maybe								Every Time	
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
Facilities Maintenance-man												
Helmsman												
Mess Cook												
Lookout												

When you have finished with this page, turn fold-out I in and continue with Part III of the questionnaire.

OUTCOMES - FOLD-OUT 1

- A. \_\_\_\_\_
- B. \_\_\_\_\_
- C. \_\_\_\_\_
- D. \_\_\_\_\_
- E. \_\_\_\_\_

After you have listed your five outcomes, keep this page open since you will be using it in answering other questions in this section.

### **PART III**

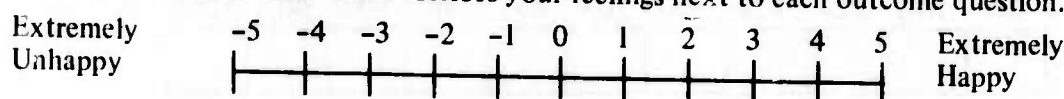
In the previous section, we asked you what outcomes influence you the most in the way you feel about jobs and the chances of receiving these outcomes from different jobs. Now we want to know what outcomes influence how you spend your time in your current assignments.

Look the following list of outcomes over, then choose the five outcomes that are most important in influencing how you choose to spend your time in your assignment and write them on Fold-out II (page 18). As before, choose the most important one first and so until you have filled in the five lines (A-E) on the foldout page. Feel free to add outcomes to this list and the foldout page if they are more important to you than the ones listed below.

- \_\_\_\_\_ Lots of liberty or leave
- \_\_\_\_\_ Criticized for my work
- \_\_\_\_\_ Good relationships with the guys on the job
- \_\_\_\_\_ A feeling of accomplishment
- \_\_\_\_\_ A say in how the work gets done
- \_\_\_\_\_ High production
- \_\_\_\_\_ Docked Pay
- \_\_\_\_\_ Lots of watchstanding
- \_\_\_\_\_ A demotion
- \_\_\_\_\_ Monotonous or dull work
- \_\_\_\_\_ An effective unit
- \_\_\_\_\_ Interesting work
- \_\_\_\_\_ A choice in task assignment
- \_\_\_\_\_ Recognition for my performance
- \_\_\_\_\_ Help from the top in getting good school or job assignments
- \_\_\_\_\_ Time to get my work done
- \_\_\_\_\_ Lots of "dirty" work (special details)
- \_\_\_\_\_ A say in rules that affect me
- \_\_\_\_\_ Lots of busy work
- \_\_\_\_\_ Additional work
- \_\_\_\_\_ A promotion
- \_\_\_\_\_ Opportunity to work with my friends
- \_\_\_\_\_ Lots of free time off the job
- \_\_\_\_\_ Time with my family and/or friends
- \_\_\_\_\_
- \_\_\_\_\_

## SECTION A

For each of the five outcomes listed on Fold-out II, we would like to know how happy you would feel if you were to receive it, and how you would feel if you did not receive it. As before, use the scale below to rate your happiness of receiving each outcome. Put the number on the scale that best describes your feelings next to each outcome question.



1. How happy would you be to get Outcome A? \_\_\_\_\_
2. How happy would you be to get Outcome B? \_\_\_\_\_
3. How happy would you be to get Outcome C? \_\_\_\_\_
4. How happy would you be to get Outcome D? \_\_\_\_\_
5. How happy would you be to get Outcome E? \_\_\_\_\_

Now as before, using the same scale as above, rate the desirability of not receiving each outcome. As before, put the number on the scale that best describes your feelings next to each outcome question.

7. How happy would you be not to get Outcome A? \_\_\_\_\_
8. How happy would you be not to get Outcome B? \_\_\_\_\_
9. How happy would you be not to get Outcome C? \_\_\_\_\_
10. How happy would you be not to get Outcome D? \_\_\_\_\_
11. How happy would you be not to get Outcome E? \_\_\_\_\_

## SECTION B

In this section we would like to know what you think your chances would be of getting each of the five outcomes you have just selected if you did each of the things listed below. This is the same list of things we asked you about in Part I of this questionnaire.

Using the boxes below, estimate your chances of receiving each outcome (A-E), if, for the majority of the time, you did what each statement says. For each statement below, ask yourself: "If I did this most of the time, what are the chances I would receive outcome A?" Put the letter A in the appropriate box for that statement, then consider outcome B. Continue estimating your chances of getting each outcome for a statement before moving on to the next statement. You should have all five outcome letters (A-E) in the boxes for each statement. You can put more than one letter in a box.

### EXAMPLE

#### Chances of Receiving Outcome

1. Voluntarily use liberty or after-working hours to work on useful tasks, in addition to fully using work time.

No Way

Every Time

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
E				A		D		BC			

Now turn to the next page to fill in the boxes for each statement presented.

1. Voluntarily use liberty or after-working hours to work on useful tasks, in addition to fully using work time.

No Way

Every Time

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

2. Voluntarily use normal breaks and meal time to work on useful tasks in addition to fully using work time.

No Way

Every Time

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

3. During working hours, complete assigned work early and then begin working a new task or ask for a new assignment.

No Way

Every Time

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

4. During working hours, complete assigned work early and then wait for next assignment.

No Way

Every Time

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

5. During working hours, take as much time as possible to complete assigned tasks.

No Way

Every Time

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

6. Seek assistance from others to help complete my assigned task

No Way

Every Time

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

7. Delay working on assigned tasks as long as possible.

No Way

Every Time

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. Avoid being given task assignments.

No Way

Every Time

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. Find ways to be away from workplace.

No Way

Every Time

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. Don't work on assigned tasks.

No Way

Every Time


0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



#### **PART IV**


1. Using the scale below, how well do you feel the outcomes used in this questionnaire are ones that actually influence your job preferences and behavior? (circle one)

Not At All      0   1   2   3   4   5   6   7   8   9   10      Very Well




2. How well do you feel this questionnaire represents the different ways you may spend your time on your job? (circle one)

Not At All      0   1   2   3   4   5   6   7   8   9   10      Very Well



3. Generally speaking, how well do you feel this questionnaire represents the way you think about jobs? (circle one)

Not At All      0   1   2   3   4   5   6   7   8   9   10      Very Well



4. What things might influence the way you feel about jobs that were not mentioned in this questionnaire?

OUTCOMES - FOLD-OUT II

- A. \_\_\_\_\_
- B. \_\_\_\_\_
- C. \_\_\_\_\_
- D. \_\_\_\_\_
- E. \_\_\_\_\_

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